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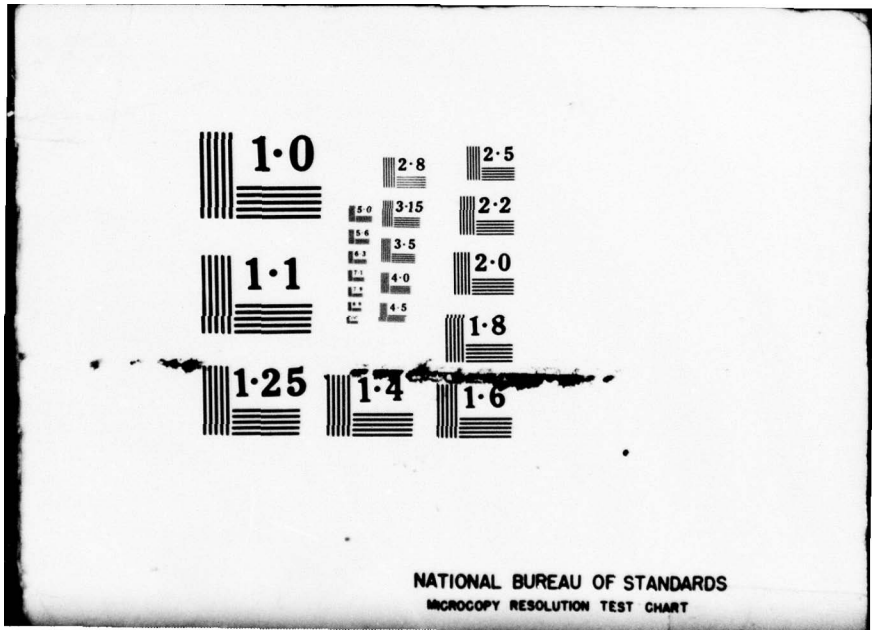
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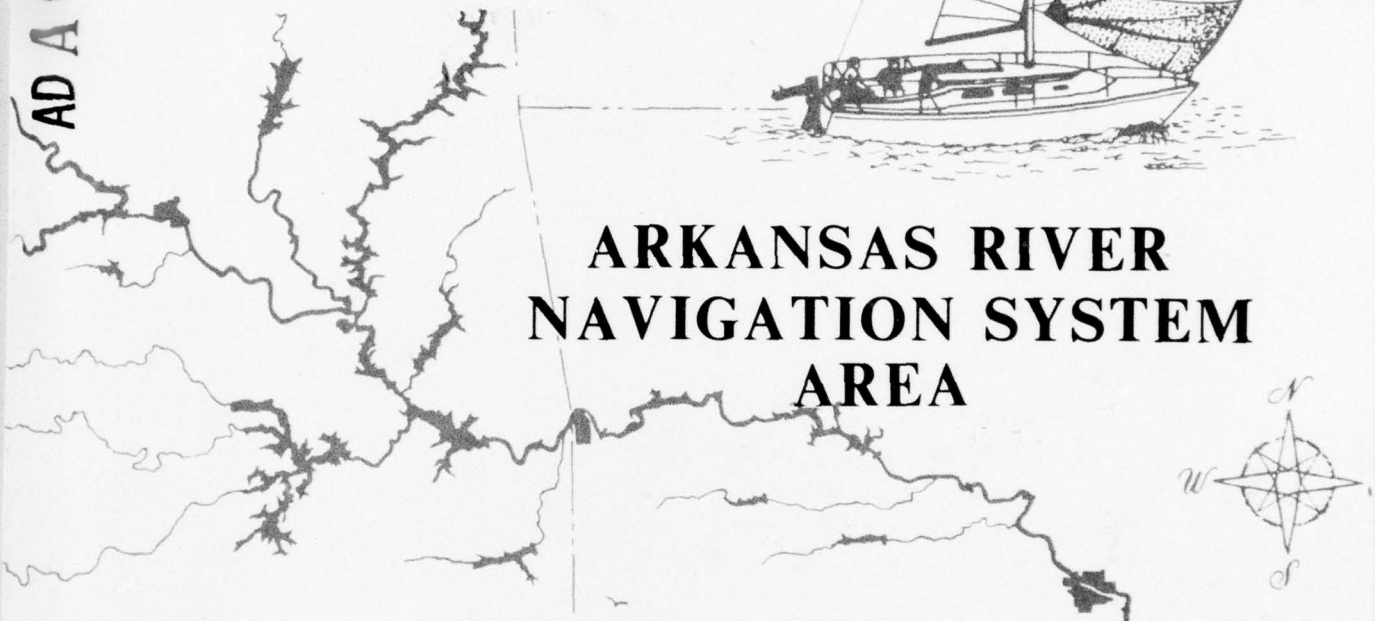
RECENT DEVELOPMENTS IN THE McCLELLAN-KERR ARKANSAS RIVER NAVIGATION SYSTEM AREA



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KINGMAN BUILDING
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APRIL 1977 RESEARCH REPORT 77-R1

RECENT DEVELOPMENTS IN THE McCLELLAN-KERR ARKANSAS RIVER NAVIGATION SYSTEM AREA

A Report Submitted to:

U.S. Army Engineer Institute for Water Resources
Kingman Building
Fort Belvoir, Virginia 22060

by

U.S. Army Engineer Division, Southwestern
Dallas, Texas 75202

APRIL 1977

IWR Research Report 77-R1

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This report brings together data and description of demographic, economic development, and public sectors which identify current conditions in the area of the McClellan-Kerr Arkansas River Navigation System for the years 1971-1974. The project includes the navigation channel extending from the Mississippi River to Catoosa, Oklahoma and the three major upstream lakes which were originally authorized in the navigation plan, costing over $1.2 billion. The primary impact area described in the report includes 28 → next page

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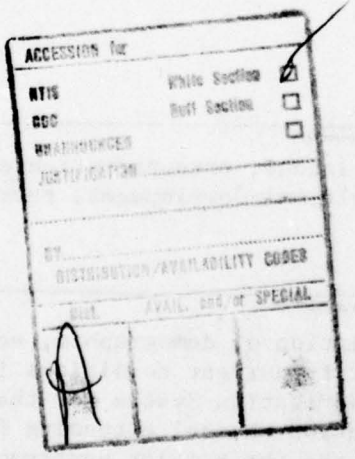
counties bordering the waterway and the three upstream lakes.



This report is one of a series of impact-studies by the Institute for Water Resources dealing with the McClellan-Kerr Arkansas River Navigation System. All the reports listed below may be purchased from:

National Technical Information Service
U.S. Department of Commerce
Springfield, Virginia 22151

1.) "Recent Developments in the McClellan-Kerr Arkansas River Navigation System Area." IWR Research Report 77-R1

2.) "A Research Strategy for Social Impact Assesment: A Tale of Three Cities." IWR Contract Report 77-R2

3.) "An Application of the Interregional I/O Model for the Study of the Impact of the McClellan-Kerr Arkansas River Multiple Purpose Project." IWR Contract Report 77-2

4.) "Analysis of Expenditures for Outdoor Recreation at the McClellan-Kerr Arkansas River Navigation System." IWR Contract Report 77-4

5.) "Population Change, Migration and Displacement Along the McClellan-Kerr Arkansas River Navigation System." IWR Contract Report 77-5

6.) "McClellan-Kerr Arkansas River Navigation System: Hydroelectric Power Generation." IWR Contract Report 77-6

7.) "A River, A Region and A Research Problem." IWR Research Report 71-6

8.) "Regional Response Through Port Development: An Economic Case Study on the McClellan-Kerr Arkansas River Project." IWR Contract Report 74-5

9.) "Evaluation of Interregional Input-Output Models for Potential Use in the McClellan-Kerr Arkansas River Multiple Purpose Project Impact Study." IWR Contract Report 74-6

10.) "Discriminant Analysis Applied to Commodity Shipments in the Arkansas River Area." IWR Research Report 74-R2

11.) "An Overview of the Impact Study of the McClellan-Kerr Multiple Purpose Arkansas River System." IWR Research Report 75-R3

These reports are not to be construed as necessarily representing the views of the federal government or of the Army Corps of Engineers.

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in the Area of

THE McCLELLAN-KERR ARKANSAS RIVER NAVIGATION SYSTEM

Chapter I

INTRODUCTION

Purpose. The purpose of this effort is to assemble demographic, economic development, and public sector data which will identify current conditions in the area of the Navigation System. The report endeavors to orient the reader toward the importance of the project to the region studied and toward the general Socio-economic significance of the project as it relates to the region and the Nation.

Description. Development of the McClellan-Kerr Arkansas River Navigation System for navigation, flood control, hydroelectric power generation, and other purposes was the largest civil works project ever undertaken by the US Army Corps of Engineers prior to the 1970's. The Navigation Plan was authorized by Congress in the River and Harbor Act of 24 July 1946 and construction began in the 1950's.

The entire 448-mile length of the waterway was opened for navigation in December 1970. The navigation channel begins at the confluence of the White and Mississippi Rivers, proceeds ten miles upstream on the White to the man made Arkansas Post Canal, then nine miles through the

canal to the Arkansas River. It crosses the State of Arkansas and into Oklahoma to the mouth of the Verdigris River at Muskogee, Oklahoma, and terminates 51 miles upstream on the Verdigris at Catoosa, Oklahoma, near Tulsa.

A nine-foot draft waterway provides a significant addition to the highway, rail and pipeline transportation network in Arkansas and Oklahoma, with significant impacts extending into Missouri and Kansas. Grain product provides support for domestic and foreign food supply needs. Construction and fabrication industries are supported by iron and steel markets. Energy commodities form a growing share of waterway movements. Public and private river ports, and expanding industrial parks are forming intermodal transportation linkages. Materials handling and warehousing functions are important in industrial development strategies. In 1974 there were about 6,000,000 tons of commodities moved on the waterway. Sand and gravel, petroleum products, rock, bauxite, iron and steel, coal and soybeans were the principal commodities shipped.

Floodwaters are stored in seven upstream lakes in Oklahoma where about 6 million acre-feet of storage space is reserved for flood regulation as part of the Navigation System. Two flood control lakes in Arkansas make further contributions to flood reduction features of the System. The navigation locks and dams, including the four multiple purpose lakes, Dardanelle, Ozark, Robert S. Kerr, and Webbers Falls, have no flood control storage. Flood damages prevented through 1975

totaled $139,305,000, with substantial quantities being prevented during the years 1973-1975.

Hydroelectric power is generated at ten locations in the system, two of which are in Arkansas. The average annual potential energy from these ten powerplants is in excess of three billion kilowatt-hours annually, enough to supply the annual needs of one million persons, and save the use of millions of barrels of oil.

The Navigation System is used annually by millions of persons who enjoy the vast expanse of water and scenic areas made more accessible or enhanced by the project. The Corps now has 56 parks in operation and nine parks reserved for future development. Seven parks were developed and two sites have been identified for future development by state and local organizations.

Economic development trends indicate substantial industrial growth, a reversal in outmigration, and increased incomes. About $3 billion in new locations or expansions of plants in the waterway area have been announced through 1973 and an additional investment of no less than $174 million during 1974.

Definitions. The definition of at least two different levels of development of water resources within the Arkansas Basin is required to discuss and summarize data pertaining to specific developments on the Arkansas River and tributaries in Arkansas and Oklahoma.

The projects in the Navigation Plan and in the Navigation System

include one or more of the following purposes: flood control, bank stabilization, navigation, hydroelectric power, water supply, fish and wildlife, and recreation. Sedimentation control, although not identified as a specific purpose, is inherent in those projects where sediment control is required in order to achieve those benefits claimed over the period of analysis.

First, those projects included in the McClellan-Kerr Arkansas River Navigation System, as it was recently named by Congress, are discussed. The Navigation System is that system defined in Public Law 91-649, January 5, 1971, entitled "An Act to change the name of certain projects for navigation and other purposes on the Arkansas River." It states:

> "Be it enacted by the Senate and House of Representatives of the United States of America in Congres assembled, that (a) the Arkansas River navigation and comprehensive development project authorized by the Act entitled 'An Act authorizing the construction of certain public works on rivers and harbors for flood control, and for other purposes', approved June 28, 1938 (52 Stat. 1215), as amended and supplemented, shall be known and designated hereafter as the McClellan-Kerr Arkansas River navigation system."

The McClellan-Kerr Arkansas River Navigation System includes all those projects and features included in the Navigation Plan plus four major upstream lakes and a number of other upstream lakes. These four lakes are Tenkiller Ferry on the Illinois River, Fort Gibson, Markham Ferry and Pensacola on the Grand River. These latter two projects are non-Federal projects, but some Federal flood control capacity is included in them. Other upstream lakes within the navigation system are: Copan, Skiatook, Candy, Birch, Sand, Kaw, Hulah, Blue Mountain, Nimrod, Wister, Heyburn, and Carl Blackwell.

Second, those projects included in the Navigation Plan as a part of the Navigation System, specifically, those developments associated with the estimated project cost of $1.2 billion and the outputs thereto, are discussed. The Navigation Plan includes the following projects and features: seventeen locks and dams, the navigation aids, bank stabilization and channel rectification, four mainstem lakes (Dardanelle, Ozark, R. S. Kerr, Webbers Falls), and three upstream lakes (Eufaula, Keystone and Oologah).

During the following discussions, references may be made to the Navigation System or to the Navigation Plan with the above definitions in mind when these terms are used. Also, where necessary the area under discussion may be further refined to selected counties which are appropriate for the subject under consideration in specific chapters of the report.

Project Outputs. A summary of project outputs of the Navigation Plan is presented in table 1. The major outputs are the values of flood damages prevented, the savings in transportation costs, the generation and sale of hydroelectric power, recreation visitations which includes fish and wildlife uses, and water supply for municipal and industrial uses.

Flood damage prevention benefits result from preventing damages to crops, roads, highways, bridges, houses, commercial buildings and other damageable real property and/or personal property. These flood damages prevented vary from year to year as shown by the table, from about

$3,000,000 in 1972 to about $48,000,000 in 1975, with the accumulative total reaching more than $139,000,000 in 1975.

Table 1. Summary of Project Outputs, Navigation Plan, 1972-1975

Output Category	Unit of Measure	Quantity of Outputs 1972	1973	1974	1975
Flood Damages Prevented					
- annual	dollars	2,837,000	22,536,000	51,100,000	47,947,000
- accumulative	dollars	17,722,000	40,258,000	91,358,000	139,305,000
Commerce shipped[1/]	tons	5,337,000	4,956,000	6,000,000	5,157,000
Power Generation	kwh(1000)	1,162,000	2,558,000	3,256,000	2,980,000
Recreation[2/]	visits	13,160,000	13,904,000	14,305,000	15,819,000
Water Supply Storage					
- allocated	acre feet	125,100	125,100	125,100	125,100
- contracted	acre feet	66,780	66,780	66,780	66,780

Source: Annual Report on Arkansas River Basin Activities, by US Army Corps of Engineers, Southwestern Division, except flood damages prevented came from Annual Report of Chief of Engineers. (Note: Flood Damages prevented and Water Supply data are for fiscal years, while the other data is for calendar years.)

1/ Waterborne Commerce Statistics, CY 1975.
2/ Includes Fish and Wildlife uses.

Total tonnages moved on the Arkansas waterway have grown from slightly more than 1.2 million tons in 1968 to a high this far of 6.0 million tons during 1974. Savings from tonnages vary depending upon the type of product being transported and distance traveled, e.g., here is less savings per ton for sand and gravel which moves locally versus iron and steel products, which moves from other states.

Electrical energy generated from eight completed projects producing

hydroelectric power has increased from 1.2 billion Kilowatt-hours of energy in 1972 to a high of 3.3 billion Kilowatt-hours in 1974. Dependable capacity for eight power projects is 631,000 kw, with an estimated energy output of 1,713,500 kwh annually. Hydroelectric power generated from eight power plants saved the equivalent of almost eight million tons of coal, or nearly 30 million barrels of oil, or 180 billion cubic feet of gas which would have been required to generate an equal amount of power using either of these fuels.

Recreation visitation has been rather steady during these three years, varying from about 13 million visits in 1972 to 16 million visits in 1975.

Water supply storage allocated in reservoirs of the Navigation Plan is 125,100 acre feet. Of this amount, almost 67,000 acre feet has been contracted by non-Federal interests for use as municipal and/or industrial purposes. If the entire water supply storage allocated in these reservoirs was used once each year, this volume would amount to 40.8 billion gallons of water.

The general area considered in this report is shown in figure 1. It encompasses generally those counties adjacent to or near the waterway which have had general or specific impacts associated with the waterway.

Figure 1. General Impact Area of the Navigation Plan Features of the McClellan-Kerr Arkansas River Navigation System, 1975.

Chapter II

NATURAL RESOURCES

Physical Characteristics. The entire Arkansas River Basin has a drainage area of 160,650 square miles. From its source on the eastern face of the Rocky Mountains near Leadville, Colorado, the Arkansas River flows southeasterly through Colorado, Kansas, Oklahoma, and Arkansas to join the Mississippi River at a point about 575 miles upstream from the head of Passes, Louisiana. From its source at about elevation 14,000 feet, msl, the fall of the river ranges from 110 feet per mile near Leadville, Colorado, to 2.2 feet per mile at Tulsa, Oklahoma, and 0.4 foot per mile near the mouth. Major tributaries of the Arkansas River are the Salt Fork of the Arkansas, Cimmaron, Verdigris, Grand (Neosho), Illinois, Canadian, Poteau, Petit Jean, and Fourche La Fave Rivers. Plate 1 shows the lower basin and location of the existing projects of the Navigation System and the Navigation Plan.

The upper portion of the basin in Colorado is mountainous and the stream flows through deep gorges and narrow valleys with steep gradients. Below Pueblo, Colorado, the valleys begin to widen and the gradient decreases. Within the Tulsa District, which includes the area below Great Bend, Kansas (river mile 868.7), the river is crooked and subject to shifting channels.

The mean annual precipitation ranges from 15 inches in the western portion of the basin to 52 inches at the mouth. The greatest amount of precipitation occurs in late spring and early summer in the western

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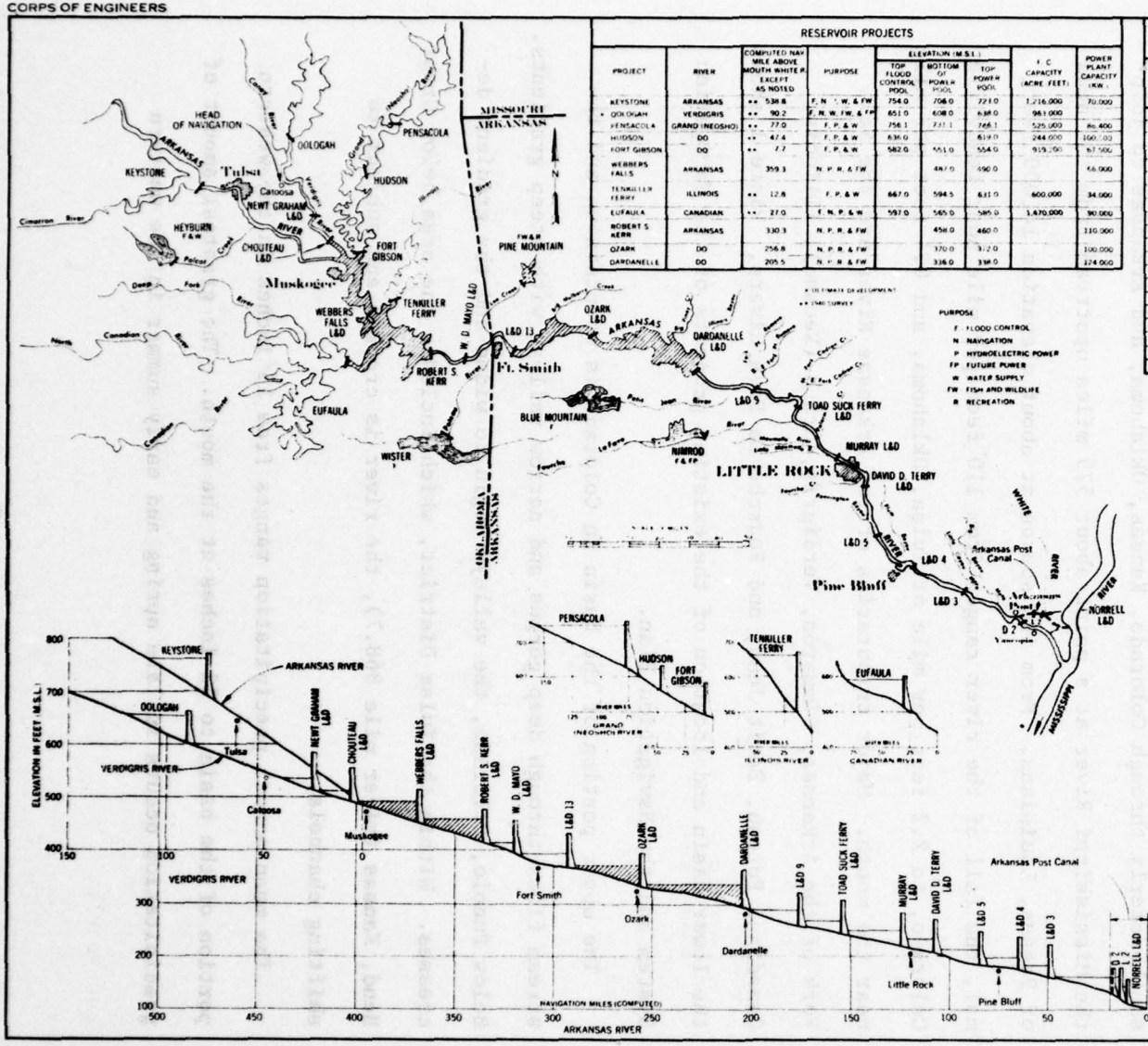
U.S. ARMY



RESERVOIR PROJECTS

PROJECT	RIVER	COMPUTED NAV MILE ABOVE MOUTH WHITE R. EXCEPT AS NOTED	PURPOSE	ELEVATION (M.S.L.) TOP FLOOD CONTROL POOL	ELEVATION (M.S.L.) BOTTOM OF POWER POOL	ELEVATION (M.S.L.) TOP POWER POOL	F. C. CAPACITY (ACRE FEET)	POWER PLANT CAPACITY (KW)
KEYSTONE	ARKANSAS	** 538.8	F, N, W, & FW	754.0	708.0	721.0	1,216,000	70,000
* OOLOGAH	VERDIGRIS	** 90.2	F, N, W, FW, & FP	651.0	608.0	638.0	961,000	
PENSACOLA	GRAND (NEOSHO)	** 77.0	F, P, & W	758.1	737.1	746.1	525,000	86,400
HUDSON	DO	** 47.4	F, P, & W	636.0		619.0	244,000	100,000
FORT GIBSON	DO	** 7.7	F, P, & W	582.0	551.0	554.0	919,000	97,500
WEBBERS FALLS	ARKANSAS	359.3	N, P, R, & FW		487.0	490.0		66,000
TENKILLER FERRY	ILLINOIS	** 12.8	F, P, & W	667.0	594.5	631.0	600,000	34,000
EUFAULA	CANADIAN	** 27.0	F, N, P, & W	597.0	565.0	585.0	1,470,000	90,000
ROBERT S KERR	ARKANSAS	330.3	N, P, R, & FW		456.0	460.0		110,000
OZARK	DO	256.8	N, P, R, & FW		370.0	372.0		100,000
DARDANELLE	DO	205.5	N, P, R, & FW		336.0	338.0		124,000

NAVIGATION PROJECTS
River and Harbor

STRUCTURE		NAVIGATION MILE (COMPUTED)		UPPER POOL ELEVATION (FEET M.S.L.)	LOWER POOL ELEVATION (FEET M.S.L.)
NEAT GRAHAM L&D		26.7	VERDIGRIS R.	532.0	511.0
CHOUTEAU DAM	(2)	8.2	DO	511.0	490.0
CHOUTEAU LOCK		6.5	DO	511.0	490.0
WEBBERS FALLS L&D	(1)	368.9	ARKANSAS R.	490.0	460.0
ROBERT S. KERR L&D	(1)	336.2	DO	460.0	412.0
W. D. MAYO L&D		319.6	DO	412.0	392.0
L&D NO. 13		292.8	DO	392.0	372.0
OZARK L&D	(1)	256.8	DO	372.0	338.0
L&D NO. 11		(DELETED)			
DARDANELLE L&D	(1)	205.5	DO	338.0	284.0 287.0
L&D NO. 9		176.9	DO	284.0 287.0	265.0
TOAD SUCK FERRY L&D		155.9	DO	265.0	249.0
MURRAY L&D		125.4	DO	249.0	231.0
DAVID D. TERRY L&D		108.1	DO	231.0	213.0
L&D NO. 5		86.3	DO	213.0	196.0
L&D NO. 4		66.0	DO	196.0	187.0
L&D NO. 3		50.2	DO	187.0	162.0
DAM NO. 2	3)	40.5	DO	162.0	ARKANSAS R.
LOCK NO. 2		13.3		162.0	142.0
NORRELL L&D		10.3		142.0	112 (WHITE R.)

(1) MULTIPLE PURPOSE
(2) MILES ABOVE MOUTH OF VERDIGRIS RIVER
(3) LOCATED ON ARKANSAS RIVER 2.2 MILES BELOW UPSTREAM END OF ARKANSAS POST CANAL
● LOCATED ON OLD RIVER CHANNEL 8.2 MILE DOWNSTREAM OF JUNCTION WITH NAVIGATION CHANNEL

ARKANSAS RIVER AND TRIBUTARIES
ARKANSAS AND OKLAHOMA

NAVIGATION FEATURES
GENERAL PLAN AND PROFILE

SCALE AS SHOWN

LITTLE ROCK DISTRICT, CORPS OF ENGINEERS
LITTLE ROCK, ARKANSAS, JULY 1972

DRAWN GAH
TRACED GAH
CHECKED KSG

PLATE 1

portion of the basin and in late winter and early spring in the eastern portion of the basin. The normal precipitation for selected stations is shown in table 1. The mean annual snowfall ranges from 21 inches near Dodge City, Kansas to 3 inches in the eastern portion of the basin.

Table 2 Normal Precipitation of Selected Locations in the Arkansas River Basin, 1941-1970 Averages.

	DODGE CITY, KS	WICHITA KS	TULSA OKLA	FORT SMITH ARK	LITTLE ROCK ARK
January	0.48	0.82	1.50	2.38	4.24
February	0.60	0.97	1.89	3.20	4.42
March	1.14	1.80	2.57	3.64	4.93
April	1.69	2.95	4.06	4.74	5.25
May	3.10	3.63	5.22	5.48	5.30
June	3.20	4.40	4.78	3.93	3.50
July	3.02	4.41	3.55	3.24	3.38
August	2.65	3.08	2.81	2.91	3.01
September	1.67	3.67	3.86	3.31	3.55
October	1.57	2.42	2.51	3.47	2.99
November	0.58	1.18	1.90	3.08	3.86
December	0.52	1.13	1.58	2.89	4.09
Annual	20.22	30.46	36.23	42.27	48.52

Source 1.

The average annual runoff varies from less than 0.5 inch in the western plains to 18 inches in central Arkansas. Floods occur more frequently during spring months, but records show that large floods may occur at any time during the year. The recorded flows at Little Rock have ranged from a low of 850 cfs on 23 August 1934 to a high of 536,000 cfs on 27 May 1943. The average recorded flow at Little Rock for a 46-year period ending 30 September 1973 is 40,260 cfs (29,170,000 acre-feet per year).

ENVIRONMENTAL SETTING

The McClellan-Kerr Arkansas River Navigation System is a major feature of the Arkansas River Basin. The navigation system is situated along the Verdigris and Arkansas River flood plains and vegetatively can be classified as a Bottomland (Flood plain) Association bordered by Oak-Hickory Forest and Tallgrass Prairie Association. The flood plain flora and fauna are quite diverse because their range borders many upland associations, principally the Ozark and Ouachita Mountain Ranges. This region's location near the western limits of the eastern deciduous forest and the eastern limits of the prairie further increases the biotic diversity of the area. The flood plain vegetation commonly consists of a deciduous forest with associated vines, shrubs, and herbs beneath. Present land use practices have reduced the amount of forest and increased the amount of agriculture and grasslands.

Fish and wildlife resources of the Arkansas River Valley are widely varied. White-tailed deer is the principle big game animal in the area. A limited number of black bear inhabit the wooded bottomland near the mouth of the Arkansas River and the Ozark and Quachita National Forests. Upland game is found in varying numbers throughout the entire length of the Arkansas River. Turkeys and squirrels are found in the specific habitat types: Squirrels in the wooded areas and turkeys in a few of the isolated pine-hardwood forest areas at the lower tip of the system. Raccoons, opossums, and foxes are frequently pursued for sport. Cougar inhabit the region and are protected from hunting at all times. Minks, beavers, muskrat, raccoons, pine vole, and swamp rabbit are the more common mammals inhabiting the flood plain.

Game fish inhabiting the river include the large mouth bass, spotted bass, crappie, striped bass, walleye, white bass, channel catfish, blue catfish, flathead catfish, and various sunfishes. Some of the nongame fish commonly found in the area are buffalo, carpsucker, carp, freshwater drum, paddlefish, bowfin, shad, and gar. The Arkansas Game and Fish Commission and the Oklahoma Department of Wildlife Conservation periodically stock game fish in the river system as determined by fish population studies.

Nearly 300 species of birds are known to utilize the area. Several rare or endangered migrants include the bald eagle, peregrine falcon, and whooping crane. During the fall, winter, and spring, the marsh and water areas are constantly used by migrating and wintering water fowl including the pintail, gadwall, baldpate, canvasback, redhead, and mallard.

As far as can be determined, there are no vertebrate animals or higher plants officially classified as "endangered" where major distribution is restricted to this area. There are, however, threatened wildlife species which do appear in the basin. In summary, it could be said that the Arkansas River Valley is a dominant physiographical and ecological feature of Oklahoma and Arkansas. Its greatest biological asset is not so much the uniqueness of the environment but rather the diversity and abundance of its flora and fauna.

ENVIRONMENTAL OBSERVATIONS

Prior to construction of the navigation system, the Arkansas River was a relatively turbid, slow-flowing river with a wide, sandy channel. Stream banks were generally low, varying from about 3 to 30 feet in height. Pool areas were infrequent. Flows on the river were unpredicatable, ranging from nearly negligible to raging floods spreading for miles across fertile farmlands and communities along the river. The McClellan-Kerr Arkansas River Navigation System has created approximately 160,000 surface acres of water at normal pool elevation.

Completion of the project has benefited the fishery by reducing turbidity, stabilizing bank and channel conditions, controlled flows and by creating deeper pools. While a decrease in population size and species diversity of native fishes has taken place in the Arkansas River below Keystone Lake to Muskogee in the last 15 years, the river below Muskogee is reported to be increasing in the quantity of fishes due partially to the more stable water levels and stocking programs of fish and wildlife agencies.

Dredging, snagging, and construction of bank stabilization in alignment structures and their disposal of materials cause disruptive change in the naturally occurring (predredging) ecosystem at the specific sites where action is taken. The principle adverse effects of dredging and its disposal results from the destruction of habitat and primary food sources utilized by the aquatic and terrestrial species in and along the river which causes stresses and strains of survival until new habitat and food resources can be located elsewhere. The full extent to the severity of the channel maintenance activities upon all fish and

wildlife species is not entirely known but is believed to be of a relatively short term and localized nature.

To help mitigate project induced losses to wildlife and their habitats and to further the opportunity for hunting and fishing, the Corps of Engineers has cooperated with State and Federal Wildlife agencies and has set aside for or licensed lands to wildlife agencies.

There are three Federally operated refuges along the waterway. The Holla Bend National Wildlife Refuge of 4,000 acres is located along the Arkansas River near Dardanelle Lock and Dam in west central Arkansas. The White River Refuge of 113,000 acres is in the vicinity of the lower end of the navigation channel in eastern Arkansas. The Sequoyah National Wildlife Refuge of 20,800 acres is superimposed on the western third of the Robert S. Kerr Reservoir in east central Oklahoma.

The Corps has licensed the State of Arkansas to manage 50,000 acres in wildlife land, 42,000 acres at Dardanelle and 8,000 acres in Pool 2. In Oklahoma, the Department of Wildlife Conservation administers three areas on the navigation system for public hunting, one of 1,690 acres at Robert S. Kerr Lake, one of 3,961 acres on Webbers Falls Lake, and one of 2,197 acres in the pool of Chouteau Lock and Dam. When all of these are operating, 185,581 acres of land and water will be managed by Federal and State agencies to maintain, nurture, and attract fish and wildlife populations for the enjoyment of this and future generations.

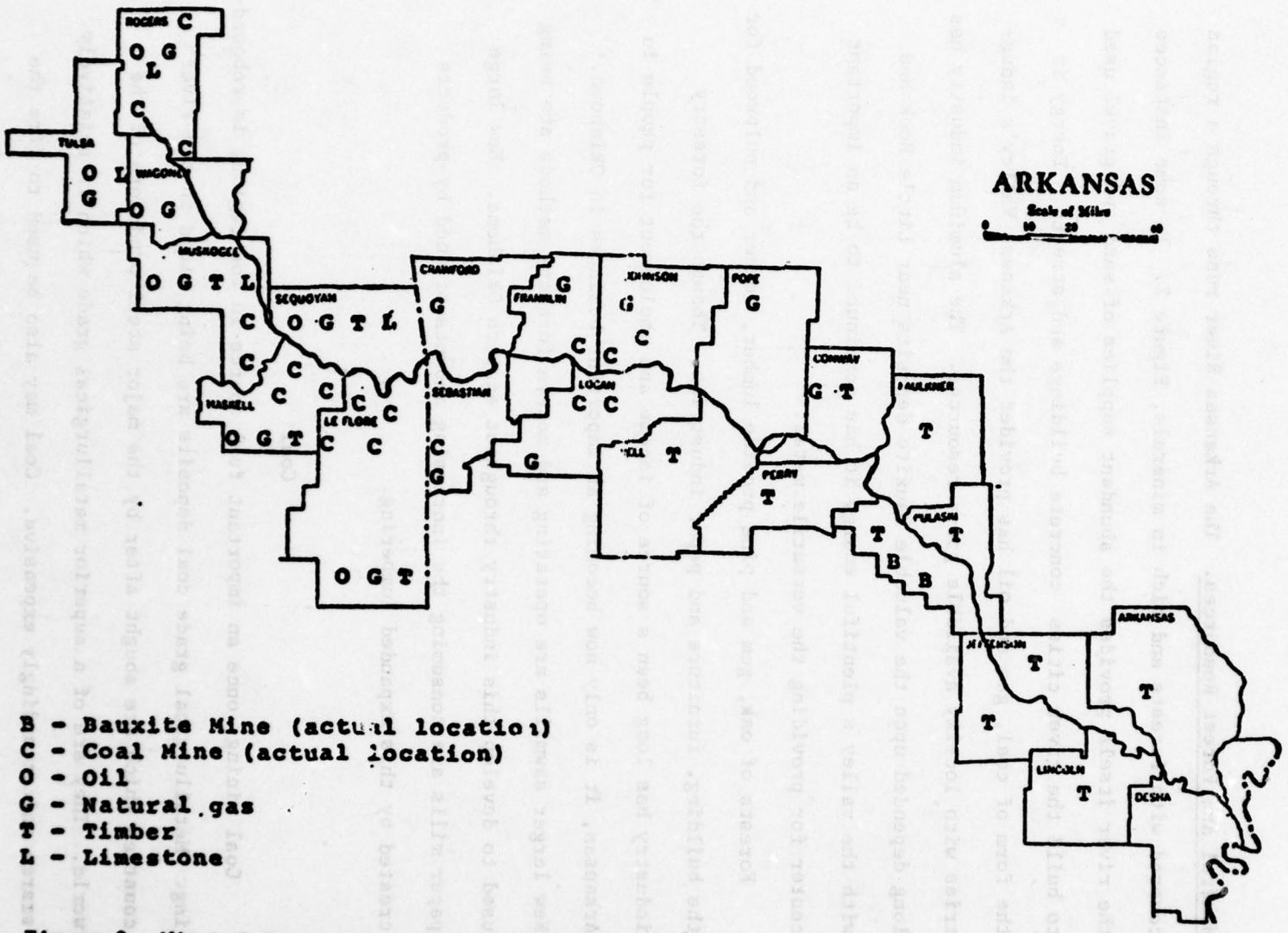
The Arkansas River historically is one of the most highly mineralized streams of this region, primarily because it and some of its tributaries flow across natural salt sources in western Oklahoma and southwestern Kansas. The five major sources of salt contribute almost 11,000 tons per day to the river. The water quality has been considered too poor to use for municipal and domestic purposes. Man-made pollution has also been a problem as cities and industry along the river have used it for waste disposal. The water in the river is hard and has concentrations of total dissolved solids in excess of the standards set for municipal and domestic water supplies by the Public Health Service and the Environmental Protection Agency. A comparison of available water quality data before and after completion of the navigation system indicates little change in water quality in so far as chemical compositon. Total dissolved solids are lower but the water is still too highly mineralized for municipal and domestic use. The water above Robert S. Kerr Lock and Dam is not considered suitable for irrigation but the water below is suitable except during periods of low flow when the mineral hazard is too high. It is possible that the water in the Arkansas River below Robert S. Kerr Lock and Dam could be used for municipal and domestic water supply. Of the parameters used in evaluating the chemical suitability of water for beneficial uses (sulfates, chlorides, nitrates, and total dissolved solids) the only one which consistently exceeds the standards for municipal and domestic use is total dissolved solids. Many groups, both in industry and government, are at work on plans to clean up the Arkansas River and its tributaries and to preserve and enhance the water quality of the waterway.

Mineral and Forest Resources. The Arkansas River runs through a region covered with forests and rich in minerals, Figure 2. In some instances the river itself provides the abundant supplies of sand and gravel used to build the river cities concrete buildings and streets. Energy in the form of coal, gas and oil has provided the Arkansas Valley's industries with locally available power resources. The aluminum industry has long depended upon the valuable bauxite deposits near Little Rock and with the valley s plentiful energy it has continued to be an important center for providing the versatile metal.

Forests of oak, gum and pine provide lumber, veneer and pulpwood for the building, furniture and paper industries. Though the forestry industry has long been a source of income and employment for people in Arkansas, it is only now becoming an important business in Oklahoma. New larger sawmills are operating and modern forestry methods are being used to develop this industry throughout eastern Oklahoma. New large paper mills are consuming the increasing amounts of wood by-products created by this expanded lumbering.

Coal

Coal mining, once an important fuel source in the region, is rebounding. Metallurgical grade coal deposits are being mined in the river counties which are sought after by the major steel producers of the world. They are of a superior metallurgical grade which is relatively scarce and accordingly expensive. Coal may also be used to fire the boilers of new big steam electric plants along the river to assure



B - Bauxite Mine (actual location)
C - Coal Mine (actual location)
O - Oil
G - Natural gas
T - Timber
L - Limestone

Figure 2. Mineral Resources Along the Waterway, 1975.
Source 2.

continued industrial growth.

Over 50% of Oklahoma's 7.2 billion tons and all of Arkansas's 2.1 billion tons of coal reserves are located in counties immediately adjacent to the Arkansas Waterway. With the completion of the waterway, a transportation alternative was made available to coal companies which made many markets more accessible. Four river coal-loading ports have been built: Tulsa, Webbers Falls, Port Carl Albert near Keota, and Van Buren.

Historically coal production in both states flourished during the 1920's. Production was used primarily by the railroads in coal-fired locomotives. With the advent of the diesel engine, the region's coal industry began to decline. The use of coal as a fuel in electric power plants helped the industry to some extent, but a gradual decline in production has continued for many years. With tne opening of the waterway and the fuel shortage, a definite reversal of this trend is occurring.

There are two distinct types of coal produced in Arkansas and Oklahoma. Steam coal or stoker coal which is used for electrical power generation or in heat intensive industries as fuel, and metallurgical coal which is used to produce coke for the steel industry. Metallurgical coal is a special product which commands a high price in world markets. Chemically it must be low in sulfur, with a low volatility and a high fixed carbon content. Production of metallurgical coal occurs primarily in Haskell and LeFlore counties in Oklahoma, and Johnson, Sebastian and Franklin counties in Arkansas. This production is leaving the area via

the waterway for markets on the east coast, Japan and Germany, and by rail to steel companies in Texas and Colorado.

Steam coal is produced for the most part in Rogers, Muskogee and Haskell counties in Oklahoma and is shipped out of this coal-producing region. In the past this coal has gone to power plants in Kansas, Nebraska, Tennessee and Florida. Coal-burning power plants (one on the Arkansas Waterway at Muskogee) and cement plants are now being constructed in both Arkansas and Oklahoma which may change this market pattern. A major portion of the steam coal reserves of both states consists of high sulfur coal, coal which contains in excess of 3% sulfur. As sulfur removal technology is improved the competitive advantage of high sulfur steam coal should improve.

Coal production for the last ten years in each of the producing counties is shown in Table 3. Production figures for individual counties are somewhat erratic, this is due to the sporadic operation of some smaller mines and, in the case of Franklin and Johnson counties in Arkansas, of a mining operation located on the county line. Production in 1974 was cut back by a six-week strike by the United Mine Workers. The location of the mining operations can be seen on Figure 2.

Table 3. Tons of Coal Produced, Selected Counties in Arkansas and Oklahoma, 1965 - 1974

	1974	1973	1972	1971	1970
ARKANSAS					
Sebastian	169,797	160,186	144,602	23,855	272
Franklin	156,305	123,254	82,280	111,084	104,068
Logan	9,855	18,050	4,290	13,490	8,053
Johnson	114,181	123,281	193,701	127,099	133,185
TOTAL	450,138	424,771	424,873	275,528	245,578
OKLAHOMA					
Rogers	1,005,453	1,027,283	927,869	779,515	797,794
Muskogee	77,676	65,101	157,451	1,702	1,122
Haskell	384,841	336,145	417,713	362,607	424,320
LeFlore	18,166	-	80,469	174,166	221,432
Wagoner	-	-	-	-	-
TOTAL	1,486,036	1,428,529	1,583,502	1,317,990	1,444,389
TOTAL ARKANSAS & OKLAHOMA	1,936,174	1,853,300	2,008,375	1,593,518	1,689,967

	1969	1968	1967	1966	1965
ARKANSAS					
Sabastian	226	363	184		
Franklin	88,226	65,662	73,416		
Logan	-	-	-		
Johnson	111,948	115,032	102,877		
TOTAL	200,400	181,057	176,477		
OKLAHOMA					
Rogers	1,293,855	668,751	431,086	226,390	237,235
Muskogee	1,085	1,525	1,414	1,620	773
Haskell	430,533	336,600	303,221	402,209	440,901
LeFlore	112,999	45,979	2,352	6,291	8,983
Wagoner	-	-	2,800	-	-
TOTAL	1,839,192	1,052,855	740,873	636,510	687,892
TOTAL ARKANSAS & OKLAHOMA	2,039,592	1,233,912	917,350		

Source 3.

Interviews with the Arkansas Geological Commission, the Oklahoma Chief Mine Inspector, and several coal companies indicate that mining operations are expanding very rapidly. In 1971 Oklahoma had ten active coal mines, this increased to 16 mines in 1974. In August 1975, there were 19 active mines, six new development permits have been issued, and four additional applications were being processed. A similar pattern of activity is present in Arkansas. While many of the new mines are being started by individuals or small companies, the larger established companies, such as Peabody Coal, Garland Coal and Mining, and Lone Star Steel, are also expanding their mining operations.

One of the new mines, operating under a developmental permit at this time, is a large underground mine near Stigler, Oklahoma, owned by the Kerr-McGee Corporation. Several new features are being incorporated in this mine which may, if successful, make deep mining practical in Oklahoma. All of the present mining operations in Oklahoma and Arkansas are strip mines, but if the Kerr-McGee mine is successful, deep mining may become more prevalent.

The development of effective sulfur removal equipment to remove sulfur from stack gas, the nation's energy problems, and the development of area markets for coal indicate that long term growth prospects for the coal industry of both states are excellent.

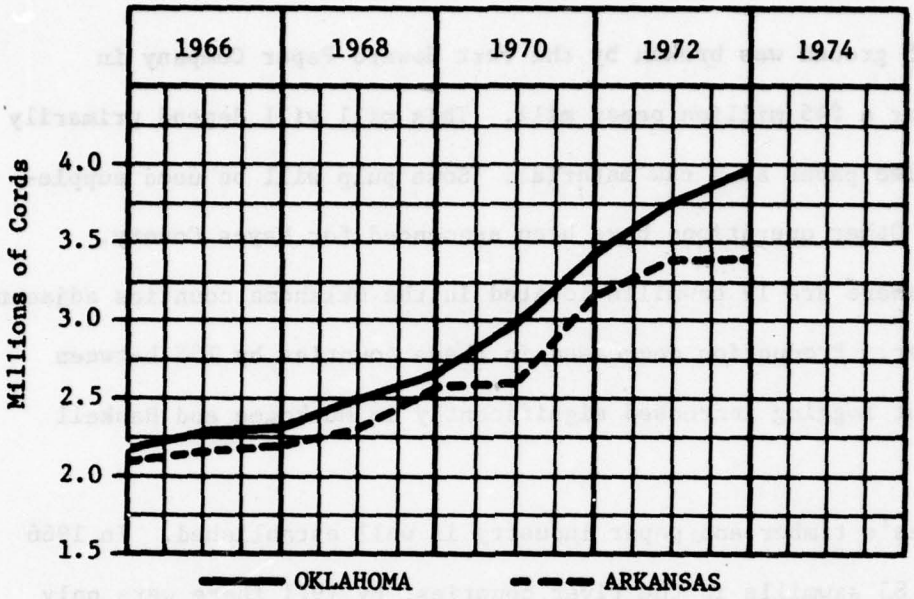


Figure 3. Pulpwood Production in the Waterway area, Arkansas and Oklahoma 1966-1973. Source 4.

The timber and pulp-paper industry in Arkansas is quite mature compared to Oklahoma. This industry is expanding in Oklahoma primarily because of the new paper mills and lumbering companies that have located in the eastern part of the state. In Oklahoma lumbering and pulpwood operations occur in Muskogee, Haskell, Sequoyah and LeFlore counties. LeFlore County produced over 21 million board feet of lumber and pulpwood in 1970. In 1962 Oklahoma had only two pulp mills with a combined capacity of 140 T/day. Now there are three mills with combined capacities of 2,300 T/day. The pulp mills and particle board operations of Weyerhaeuser Company utilize the waste from their timber and dimension lumber operations. Most of this activity is centered in McCurtain and LeFlore counties, but adjacent eastern counties offer great potential for forestry operations.

In 1975 ground was broken by the Fort Howard Paper Company in Muskogee for a $45 million paper mill. This mill will depend primarily upon recycled paper as a raw material. Some pulp will be used supplementally. Other operations have been announced for Mayes County. Presently there are 19 sawmills located in the Oklahoma counties adjacent to the river. Production decreased in these counties by 15% between 1970-72, but logging increased significantly in Muskogee and Haskell counties.

Arkansas's timber and paper industry is well established. In 1966 there were 85 sawmills in the river counties; by 1971 there were only 53. This net decrease in number is counterbalanced by the fact that several small mills vanished but more large sawmills emerged. There are 14 large sawmills in the Arkansas River counties, each cutting over three million board feet per year. These counties accounted for about 12% of the state's saw log and pulpwood production in 1971. Production approached 155 million board feet in 1971, over seven times Oklahoma's production.

There are four paper mills in the basin now, whereas in 1968 there were three. As illustrated in the chart on pulpwood production in Arkansas and Oklahoma, there has been dramatic growth cince the waterway went into operation.

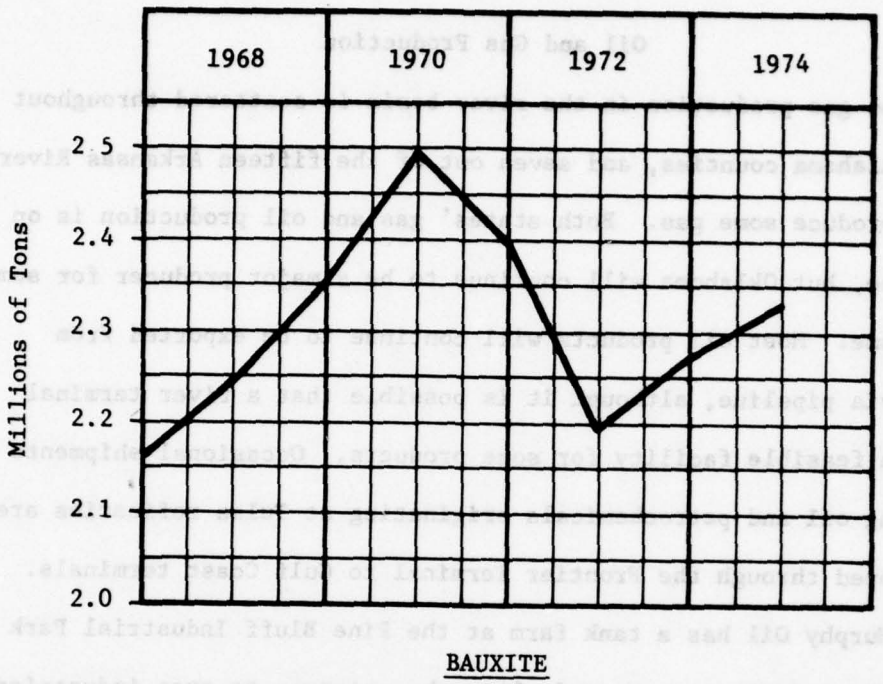


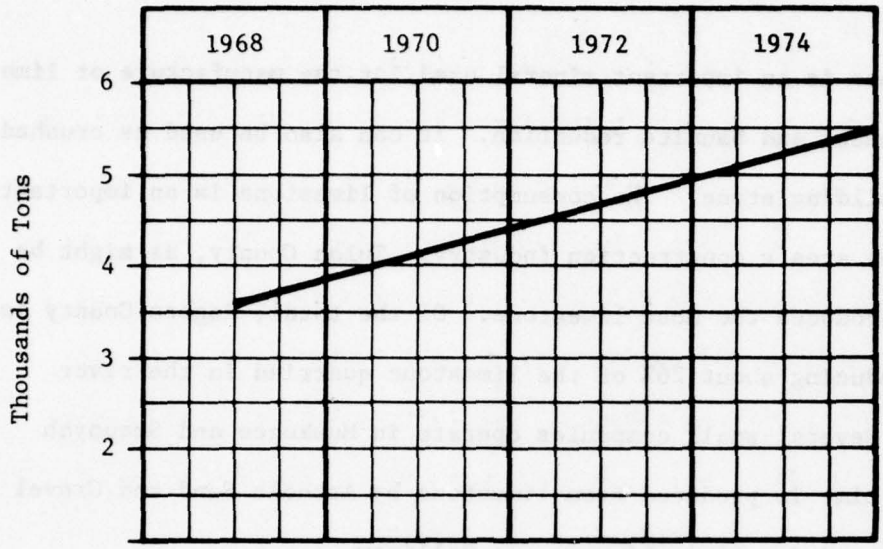
Figure 4. Bauxite Production, waterway area 1967-1974. Source 5.

Bauxite mining has been an important business in Arkansas and has formed the major part of the nation's domestic production since 1900. The mines are located just south of Little Rock near the county line. There is some production in Pulaski County, but the bulk of the ore is mined i Saline County in and near Bauxite. Production figures for 1967-1974 indicate a fairly constant production rate, varying only about 5-7% from the average. The aluminum reduction plants are being increasingly supplied with imports barged up the river. At the present rate of mining, it was estimated that the mines could operate another 10 to 15 years. There are three major companies now mining in Pulaski and Saline counties, including Alcoa, Reynolds Metal Co., and American Cyanamid Co.

Oil and Gas Production

Oil and gas production in the river basin is scattered throughout all the Oklahoma counties, and seven out of the fifteen Arkansas River counties produce some gas. Both states' gas and oil production is on the decline, but Oklahoma will continue to be a major producer for some time to come. Most oil products will continue to be exported from Oklahoma via pipeline, although it is possible that a river terminal might be a feasible facility for some products. Occasional shipments of lubricating oil and petrochemicals originating at Tulsa refineries are being shipped through the Frontier Terminal to Gulf Coast terminals. In Arkansas Murphy Oil has a tank farm at the Pine Bluff Industrial Park to load or unload fuels transported along the waterway to area industries. Arkansas Power & Light Co. has constructed facilities to unload residual fuel at their Little Rock plant. Crude oil could also be imported via the barge channel for small refineries; however, all natural gas is expected to continue to move by pipeline.

There is oil and gas production in Tulsa, Rogers, Wagoner, Muskogee, Haskell, Sequoyah and LeFlore counties in Oklahoma. Two major oil refineries in Tulsa, Sun Oil and Texaco, continue to expand production. These are located a few miles from the head of navigation. There are no refineries along the waterway. Small quantities of natural gas are produced in Sebastian, Crawford, Franklin, Logan, Johnson, Pope and Conway counties in Arkansas. Because of the oil and gas shortage there will be increased exploratory activity in the Arkansas River Basin.



LIMESTONE

Figure 5. Limestone Production in the Waterway Area, 1968-1975. Source 6.

There are great limestone beds just west of the Port of Catoosa running north and south and underlying most of northeast Oklahoma east and north of the Arkansas River. Most of Arkansas's limestone deposits are located in the Ozark region in a more or less rectangular area about 7,000 square miles in extent. This deposit is a northeastern extension of the Oklahoma fields.

Limestone is produced in the Oklahoma counties of Tulsa, Rogers, Muskogee and Sequoyah. Production has been growing at a rate of about 3-5% per year. Although there are limestone deposits in Arkansas's Johnson and Franklin counties, none has been commercially developed. In 1974 there were thirteen active limestone quarries along the river.

Limestone is an important mineral used for the manufacture of lime, portland cement and bauxite reduction. It can also be used as crushed rock and building stone. The consumption of limestone is an important index of the area's construction industry. Tulsa County, as might be expected, produces the most limestone. Of the total, Rogers County is second, producing about 26% of the limestone quarried in the river counties. Several small companies operate in Muskogee and Sequoyah counties. Lime is produced from limestone by Arkhola Sand and Gravel at Fort Gibson and St. Clair Lime Co. at Sallisaw.

Sand and Gravel

Today there are fifty sand and gravel operations in the river counties of Oklahoma and Arkansas. In Oklahoma where records have recently been kept on production, about three million tons per year are being taken from the river bottom and nearby deposits. Most of the activity is located in Tulsa, Oklahoma and Sebastian and Pulaski counties in Arkansas, mainly near city and construction areas. Commercial sand and gravel deposits are located in almost all the counties, but they are basically heavily exploited near the cities. This product is historically not moved any great distance and future mining will depend upon local road and building construction.

FOOTNOTE SOURCES

1. Report on 1974 Activities, Arkansas River Basin Coordinating Committee, by Southwestern Division, March 1975.

2. Prepared by a contractor, Richard J. Bigda and Associates, Tulsa, Oklahoma.

3. Arkansas Geological Commission and the Oklahoma Department of Mines.

4. Prepared by a contractor, Richard J. Bigda and Associates, Tulsa, Oklahoma.

5. Same as 4.

6. Same as 4.

Chapter III

POPULATION, EMPLOYMENT AND INCOME

Trends in population, labor force and income are good overall indicators of regional economic development. This chapter presents some of the key data for these variables for an area along the waterway. The area considered consists of 28 counties adjacent to the navigation channel and to the three upstream lakes (Keystone, Oologah, and Eufaula) constructed as part of the Navigation Plan.

Population. In 1974, this area contained 1.5 million persons, about half of whom were in Arkansas and half in Oklahoma, Table 4. During the decade of the 1950's, the region gained 115,000 persons---an expansion of 10.3 percent over the 1950 level. However, the geographic distribution of this growth was very different from that of the 60's and 70's. During the 50's, 23 of the region's 28 counties experienced declining population and the overall growth was due exclusively to expansion at Pine Bluff, Little Rock, Fort Smith and Tulsa. In the 1960's, only seven of the 28 counties lost population, and between 1970 and 1974, estimates indicate that the number of counties experiencing population decline dropped to four. Hence, during the project's construction period in the 60's and its operating phase beginning late in that decade, regional population growth has been much more balanced than it was in the 50's.

Since 1950, rates of population growth in the area have generally exceeded rates for the entire states of Arkansas and Oklahoma, Table 5.

Table 4. Population of Waterway Area, Arkansas and Oklahoma 1950, 1960, 1970, 1974

	Total Area	Arkansas Portion	Oklahoma Portion
1950	1,114,414	561,096	583,318
1960	1,229,114	587,296	641,818
1970	1,392,582	670,999	721,583
1974	1,476,100	721,100	755,000

Sources: 1, 2, 3

The area's population change can be divided into three components: births, deaths and net migration, Table 6. Net migration is the number of inmigrants minus the number of outmigrants. Because individuals and families often migrate in response to employment conditions, net migration is an indicator of the economic attractiveness of a region as a place to work. Net outmigration from the area during the 50's amounted to nearly 100,000 and was largely in response to declining employment opportunities in farming. However, this outmigration pattern was reversed in the 60's, and the early 70's show a generally strong pattern of net inmigration. Only seven of the area's 28 counties exhibited net outmigration between 1970 and 1974.

The racial composition of the area is far from uniform. In 1970, 8.1 percent of the Oklahoma portion was black, while in the Arkansas portion blacks accounted for 18.5 percent. The share of blacks in the area's population declined between 1960 and 1970, as more blacks moved

out than moved in. The heaviest concentrations of blacks are found in eastern Arkansas, where three counties showed black proportions in excess of 40 percent of the total population. The American Indian's share of the Oklahoma portion rose from 2.5 to 4.0 percent during the decade of the 1960's. There are few American Indians in Arkansas.

Table 5. Rates of Population Change, Waterway Area, 1950-1974

Area	Percent Change in Population 1950-60	1960-70	1970-74
Area within Arkansas	4.7	14.3	7.5
Entire state of Arkansas	-6.5	7.7	7.2
Area within Oklahoma	10.1	12.4	4.6
Entire state of Oklahoma	4.3	9.9	5.8

Sources: 1, 2, 3

Table 6. Components of Population Change, Waterway Area, 1950-1974

Period	Net Change	Births	Deaths	Net Migration
1950-60	84,700	289,930	106,639	-98,591
1960-70	165,149	265,056	127,534	27,627
1970-74	83,900	104,700	59,300	39,100

Sources: 4, 5, 6

The age distribution is affected by the kinds of migration experienced in the past. Nineteen of the 28 counties in the area show median age figures rising between 1950 and 1960, and falling between 1960 and 1970. This is associated with heavy net outmigration of relatively young people in the 50's, and the extensive reversal of net outmigration during the 60's. On the average, populations of the area's counties tend to be older relative to the populations of the entire states. Nine of the 15 Arkansas portion counties had 1970 median age levels above the 29.1 year state-wide figure, and in Oklahoma 10 of the 13 counties were above the state's 29.4 year level.

Because of recreational advantages and relatively low housing costs, it is clear that some people are migrating into the area for retirement purposes. This, of course, raises average age levels. Unfortunately, little comprehensive data are available which could help identify precisely how much of this kind of migration is occurring.

The "dying" small town has been widely noted in rural areas similar to the Arkansas waterway region. However, Table 7 shows that most of the area's cities and towns are experiencing population growth. Notice that while the number of cities in the 5,000 to 10,000 size class declined from 11 to six during the 60's, the number in the 10,000 to 25,000 class rose by six, indicating that this latter city size class provided a particularly favorable setting for development.

Table 7. Number of Towns and Cities by Population, Waterway Area, 1960 and 1970.

Size	Arkansas Portion		Oklahoma Portion		Total Region	
	1960	1970	1960	1970	1960	1970
Less than 1,000	55	67	77	80	132	147
1,000 to 2,500	10	11	23	26	33	37
2,500 to 5,000	6	7	11	13	17	20
5,000 to 10,000	7	4	4	2	11	6
10,000 to 25,000	1	5	2	4	3	9
25,000 to 50,000	1	--	1	1	2	1
50,000 to 100,000	2	3	--	--	2	3
100,000 to 250,000	1	1	--	--	1	1
250,000 to 500,000	--	--	1	1	1	1
TOTAL	83	98	119	127	202	225

Source: 7

The area contained six cities of 25,000 and more in both 1960 and 1970: Pine Bluff, Little Rock, North Little Rock, Fort Smith, Muskogee and Tulsa. The share of the area's population residing in these six cities rose from 45.8 percent in 1960 to 49.0 percent in 1970. These six cities accounted for 72.8 percent of the entire region's population growth during the 1960's.

Employment. By far the most important long-term shift in the area's employment pattern is the relative decline in farm employment. Between 1950 and 1970, the share of the area's employment in agriculture dropped from 18.2 to 3.9 percent---with the bulk of this decline occurring in the 1950's, Table 8. Increasingly common in the area is the farmer or rancher who is also regularly employed off the farm. Evidence of this is found in the fact that although the 1969 Census of Agriculture reported almost 26,000 "farm operators" in the 28 county area, the 1970 Census of Population (which asked people to give the name of the industry in which they were employed) reported only 8,400 "farmers and farm managers."

The area's employment and labor force continues to indicate more rapid expansion for women than for men. In both Arkansas and Oklahoma, the share of the area's women at work or looking for work rose from nearly 30 percent in 1960 to nearly 40 percent a decade later.

Rates for males during the same period rose from 71.6 to 72.3 percent in Arkansas, and from 73.8 to 76.8 percent in Oklahoma. However, certain counties in the area continue to exhibit relatively low shares of the population at work or looking for work. In 1970, for example, in eight of the 13 counties in the Oklahoma portion of the area, a smaller share of the male population was economically active than was the case in the state as a whole. This was true for women in 12 of the 13 counties.

Table 8. Total Employment by Place of Residence, Waterway Area, 1950, 1960 and 1970.

Area and Year	Total Employment[a]	Percent Non-agricultural	Agricultural[b]
Arkansas Portion			
1950	188,504	78.4	21.6
1960	196,367	90.7	9.3
1970	240,230	94.8	5.2
Oklahoma Portion			
1950	199,172	85.5	14.5
1960	220,347	94.8	5.2
1970	267,117	97.2	2.8
Total Region			
1950	388,022	81.8	18.2
1960	417,183	92.7	7.3
1970	510,464	96.1	3.9

a-Age 14 and over
b-Includes agriculture, forestry and fisheries

Sources: 8, 9, 10

While census data were used to describe long-term trends in employment, recent developments are indicated by reports of "covered" employment prepared by state agencies administering programs of unemployment insurance. Region-wide manufacturing employment grew 8.7 percent between 1967 and 1970, and increased by 21.2 percent between 1970 and 1974. Throughout the period since 1967, about 70 percent of the area's manufacturing employment has remained concentrated in the counties whose principal cities are Tulsa, Fort Smith and Little Rock.

Labor productivity is an economic linkage between total employment and total income. Value added per man-hour of production workers in manufacturing is a rough and partial indicator of labor productivity. In both 1963 and 1972, the area's value added per man-hour was about four-fifths of the national average, Table 9. Since the area-wide total man-hours increased by 47 percent during this period, it appears that the area has continued to be attractive for manufacturing plants which are labor intensive and pay relatively low wages.

Table 9. Value Added Per Production Worker in Manufacturing, Dollars per Man-Hour, Waterway Area and U.S. 1963, 1967, 1972.

Area	1963	1967	1972
Arkansas Portion	5.51	7.14	9.95
Oklahoma Portion	7.06	8.80	11.72
Total Area	6.15	7.89	10.63
United States	7.84	9.41	13.30

Source: 11

Personal Income. Personal income is the current income of the residents from all sources. When total personal income is divided by population, the result is per capita personal income---a useful measure of economic well-being. A tabulation of these statistical figures is shown in Table 10. For the 28-county area adjacent to the project, 1973 total personal income was $6.3 billion. The area has experienced a more rapid rate of

growth in income than the nation as a whole during the 1967-73 period, Table 11. Both total and per capita income measures grew more rapidly in Arkansas than in Oklahoma, and more rapidly after 1970 than before.

Although per capita personal income in the area is catching up slightly, a number of counties continue to exhibit relatively low levels. This is consistent with the indication of relatively low labor productivity in manufacturing shown in Table 9. Area-wide per capita personal income as a percent of the national per capita figures are as follows:

1967	84.8
1970	83.8
1973	85.7

In 1967, 14 of the area's 28 counties had per capita income levels less than two-thirds the national level--indicating relatively high incidence of poverty. By 1973, the number of counties below two-thirds the national level dropped to 10.

Two counties, Tulsa County in Oklahoma and Pulaski County in Arkansas (where Little Rock is located) dominate the geographic distribution of total personal income. In 1973, 56 percent of the area's total personal income was received by residents of these two counties.

Table 10. Total and Per Capita Personal Income, Waterway Area 1967, 1970 and 1973.

	1967	1970	1973
Total personal income (millions of dollars)			
Arkansas Portion	$1653.5	$2152.3	$3031.4
Oklahoma Portion	1992.4	2497.7	3256.7
Total Area	3645.9	4650.0	6288.1
Per capita personal income (dollars)			
Arkansas Portion	2531	3193	4264
Oklahoma Portion	2865	3448	4361
Total Area	2703	3325	4307

Source: 12.

Table 11. Percent Change in Total and Per Capita Personal Income, Waterway Area 1967-70, 1970-73 and 1967-73.

	1967-70	1970-73	1967-73
Total Personal Income		(percent)	
Arkansas Portion	30.2	40.8	83.3
Oklahoma Portion	25.4	30.4	63.5
Total Area	27.5	35.2	72.5
Total U.S.	28.5	30.4	67.5
Per Capita Personal Income			
Arkansas Portion	26.2	33.5	68.5
Oklahoma Portion	20.3	26.5	52.2
Total Area	23.0	29.5	59.3
Total U.S.	24.4	26.7	57.6

Source: 13.

FOOTNOTE SOURCES

1. 1950 Data--U.S. Bureau of the Census, Census of Population: 1960, Vol I, Characteristics of the Population. Part 38, Oklahoma, Table 27, p. 95-113 and Part 5, Arkansas, Table 27, p. 88-106.

2. 1960, 1970 Data--U.S. Bureau of the Census, Census of Population: 1970, Vol. I, Characteristics of the Population, Part 38, Oklahoma, Table 35, p. 99-118. Also, U.S. Bureau of the Census, Census of Population: 1970, General Population Characteristics, Final Report, PC(1)-B5, Arkansas, Table 35, P. 115-133.

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7. U.S. Bureau of the Census, Census of Population: 1970, Vol. I, Characteristics of the Population, Part 38, Oklahoma, Table 10, p. 18-25 and Part 5, Arkansas, Table 10, p. 18-32. Also, Characteristics of the Population, Part A, Number of Inhabitants, Section 1, United States: Alabama-Mississippi.

8. U.S. Department of Commerce, Census of Population 1950, Vol. II, Characteristics of the Population, Part 36, Oklahoma, Table 43, p. 91-100.

9. U.S. Department of Commerce, Census of Population: 1960, Vol. I, Characteristics of the Population, Part 38, Oklahoma, Table 85, p. 223-28.

10. U.S. Department of Commerce, Census of Population : 1970, Vol. 1, Characteristics of the Population, Part 38, Oklahoma, Table 123, p. 339-45.

11. U.S. Bureau of the Census, Census of Manufactures, 1963, 1967 and 1972

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13. U.S. Department of Commerce, Bureau of Economic Analysis

Chapter IV

TRANSPORTATION AND PORT DEVELOPMENT

Inland Waterway System. Prior to the presence of the Arkansas River waterway, the region was landbound without access to water transportation. Now the waterway may feed traffic into and out of the National Inland Waterway System. Access to this system enables business firms in Arkansas and Oklahoma to receive and/or ship goods via water transportation from Minneapolis-St. Paul, Minnesota; Sioux City, Iowa; Chicago, Illinois; Pittsburgh, Pennsylvania; Charleston, West Virginia; Knoxville and Nashville, Tennessee; Columbus, Georgia; Tuscaloosa, Alabama; Panama City, Florida; Mobile, Alabama; New Orleans, Louisiana; and Houston and Brownsville, Texas. In essence, the people and industry in Oklahoma and Arkansas will have available an interconnected inland waterway system with a length of about 9,000 miles on the Mississippi River and its tributaries, and an additional 5,400 miles with the inclusion of the Gulf Intercoastal Waterway, Figure 6.

Transportation Interdependence. The interdependence of all forms of U.S. transportation is much greater than is generally realized. Over 50 percent of all domestic cargo shipments require the services of more than one kind of transportation. There are, indeed, few if any important common carrier companies that could survive without cargo interchange business.

Improved transportation service, through beneficial effects on industry and commerce in any given area, often rebounds to the advantage

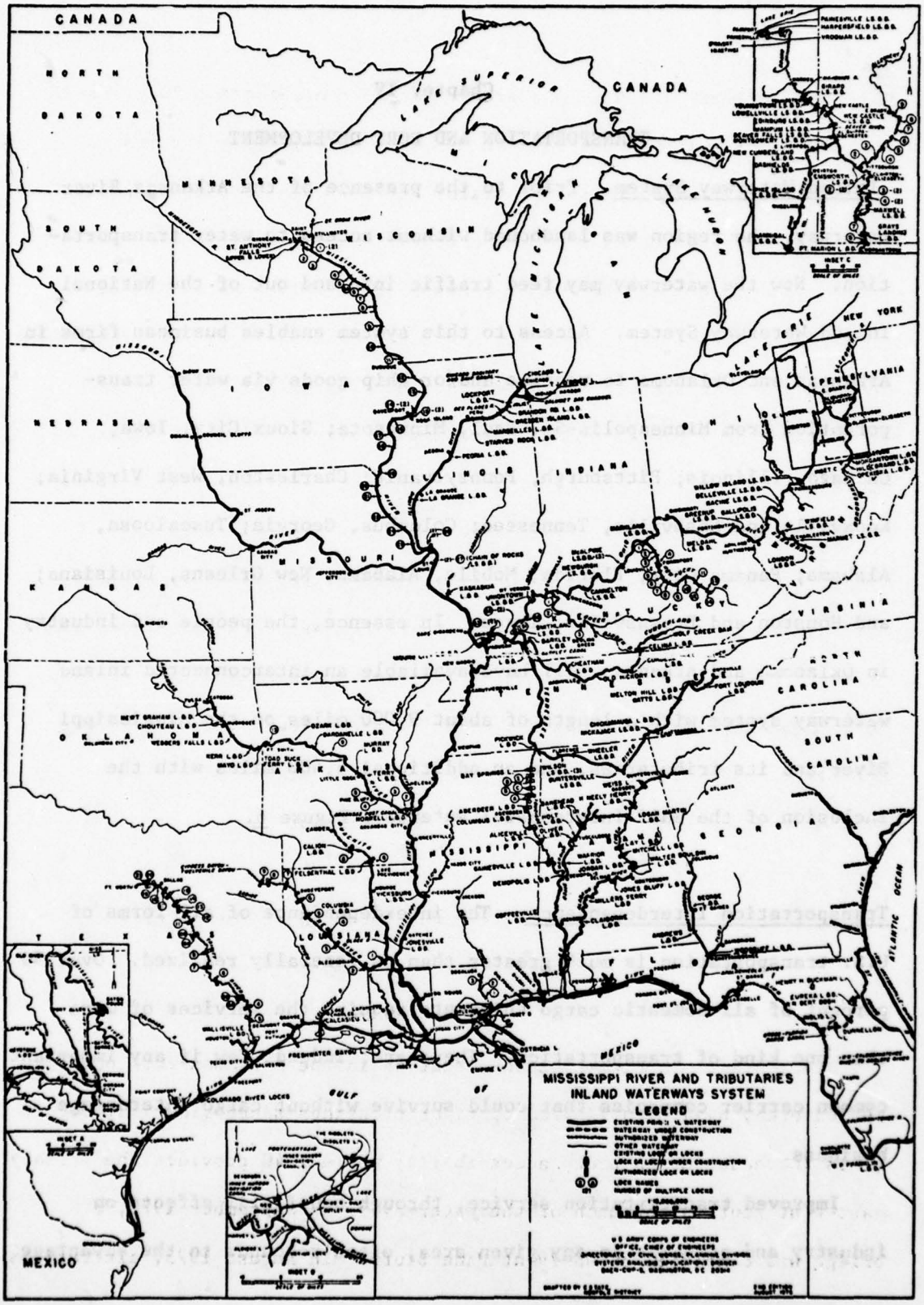
CANADA
NORTH DAKOTA
SOUTH DAKOTA
MINNESOTA
WISCONSIN
MICHIGAN
LAKE SUPERIOR
LAKE HURON
LAKE ERIE
NEW YORK
PENNSYLVANIA
OHIO
INDIANA
ILLINOIS
IOWA
NEBRASKA
KANSAS
MISSOURI
OKLAHOMA
ARKANSAS
KENTUCKY
VIRGINIA
NORTH CAROLINA
SOUTH CAROLINA
GEORGIA
MISSISSIPPI
LOUISIANA
TEXAS
FLORIDA
ATLANTIC OCEAN
GULF OF MEXICO
MEXICO
MISSISSIPPI RIVER AND TRIBUTARIES
INLAND WATERWAYS SYSTEM
LEGEND

Figure 6.

of other transportation in the area. Water transportation is particularly able to provide such results because it is largely devoted to lowest cost movement of raw materials. It so stimulates and sustains manufacturing industries that other transportation services become joint beneficiaries, through increased flows of finished product traffic.

Industries locating along the navigable waterway have many alternatives in meeting their transportation needs. Water carriers ply the inland waterways. Railroads already crisscross the Basin. Highway transport, already large, will grow as interstate highways provide truck and bus transport service within, to and from the area.

Much may be gained from encouraging the greatest possible coordination of these various modes of transport because each mode has a kind of traffic for which it is best suited. Waterways can handle the large bulk cargo needs of heavy industry at extremely low basic costs. But obviously they can transport to and from the riverside cities only. Trucks, railroads, and water carriers can work out joint arrangements, both as to rates and physical arrangements, which have extended to inland cities an opportunity for full utilization of the waterway.

Highways

Developments in highway transportation in the Arkansas portion of the waterway have been limited to river crossings since mid-1972, figure 7. (This increases north-south accessibility while I-40 provides the primary east-west route along much of the waterway.) In September 1972, a bridge was completed on US-79 at Pine Bluff. In August 1973, alterations

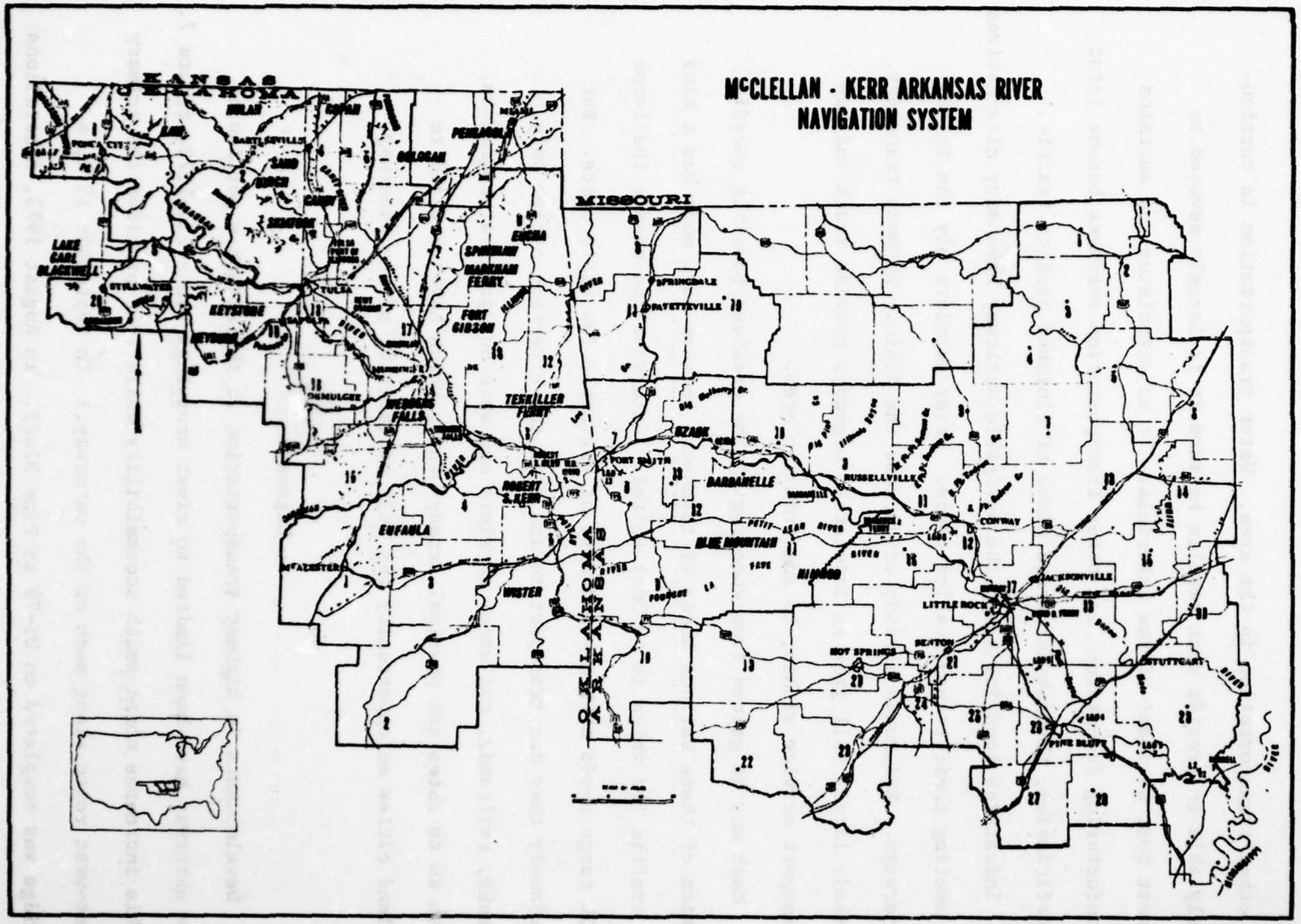

Figure 7. Transportation network, rail, truck and barge, waterway area 1975. Source 1.

to improve navigation were completed on the Broadway Street bridge in Little Rock. Also, in 1973, bridges were completed on Main Street in Little Rock and on US-64 in Fort Smith. Another crossing was created in April 1975 when the I-430 bridge at Little Rock was opened.

At the present time, plans of the Arkansas Highway Department call for several other improvements in the area of the waterway. A bridge presently under construction at Clarksville will connect Arkansas highways 22 and 194 on the south side of the waterway with I-40 and US-64 on the north side. Additional bridges are planned on the East Belt Loop at Little Rock, on Arkansas 22 at Barling (east of Fort Smith, over Lock and Dam 13), along with 9.3 miles of highway. In the future, bridges can be constructed over Lock and Dam 3 (navigation mile 50.2) and over Lock and Dam 9 (navigation mile 176.9).

In Oklahoma, new highway improvements have generally been limited to the Tulsa area. New roads to the Port of Catoosa and Keystone Dam have been constructed. Also since 1972, I-244 and US-64 have been completed in the City of Tulsa and Tulsa County.

Railways

Rail service to the river project can be roughly divided into three areas: (1) in Arkansas from Little Rock to the Mississippi River, (2) in Arkansas from Little Rock to Fort Smith, and (3) in Oklahoma from Fort Smith to the Tulsa port of Catoosa.

Rail service to the eastern portion of the river project, in Arkansas from Little Rock through Pine Bluff to the Mississippi River, is provided by the Missouri Pacific and Cotton Belt railroads which approximately parallels the Arkansas River. Further service to the eastern area is provided by rail lines that cross the Arkansas River, at Little Rock (Missouri Pacific and Rock Island), Pine Bluff (Cotton Belt), and Yancopin (Missouri Pacific), running from the northeast to the southwest.

The central portion of the river project is served by a Missouri and Rock Island railroads which run east-west from Little Rock to the Fort Smith area. These lines provide adequate service to the area along the river project; but, for north-south rail transport, commodities must be moved to either Little Rock or Fort Smith. The lack of north-south rail lines in the west-central Arkansas area is probably influenced by the mountainous terrain in north-central Arkansas and the absence of any sizable population center to the south of the river project in this area. The Kansas City Southern railroad and the St. Louis-San Francisco railroad do serve eastern Oklahoma and western Arkansas in a north-south direction.

The western portion of the river project from Fort Smith to Tulsa, located in Oklahoma, is served by a more complex net of rail lines. This allows the two major ports in this area, Tulsa-Catoosa and Muskogee, to transfer commodities by rail in essentially all directions with relative ease.

Port Development. The port development planning could have started earlier perhaps, looked further ahead, and considered a wider range of alternatives, but the overall port development in the region has been generally adequate in terms of quantity and geographic distribution of handling capacity. The development of port-related industrial parks has been reasonably adequate in terms of available space. Port and industrial park facilities appear to be comparable in quality to those built on similar waterways elsewhere.

One of the requirements for local cooperation set by the authorizing legislation was that local interests provide adequate terminal and transfer facilities for navigation. These facility requirements are further enhanced with the addition of privately owned grain loading facilities recently put into operation near Wagoner and Tulsa, Oklahoma and another grain-loading facility under construction at Webbers Falls.

Cities have some ability to grasp opportunities created by the Waterway, and their chief problem may be coordination of local developments. Where opportunities are created in rural counties, effective port development may have to await state action.

Since mid 1972 port facilities along the waterway have continued to be increased and upgraded. In site specific terms, the increase, and improvement of facilities has been quite varied but without exception, each of the major ports, in existence since 1972, has had some increase in capital investments to facilitate the handling of commerce along the river.

Private ports and loading facilities have been developed at or near the cities of Pine Bluff, North Little Rock, Little Rock, Conway, Dardanelle, Roseville, Ozark, Clarksville, Van Buren in Arkansas, and at Keota, Webbers Falls, Muskogee, Wagoner, Catoosa in Oklahoma. Most private developments have reasonable access of highways and railroads, and they have varying types of handling facilities. Most private developments have some specialized purposes such as storing, loading or unloading of grains, chemicals, coal, steel, paper, bauxite, rubber, petroleum, feeds, sand and gravel, rock, fertilizer, scrap metal and miscellaneous commodities.

The official list of the Corps of Engineers showing all terminals, as of March 1974, indicates 43 different operators along the entire waterway, which includes the five public ports (Source 2). Most of the terminals do not have access to railroads. Information about these five public ports is summarized in Table 12.

Table 12. Development at Public Ports Located Along the Waterway, Arkansas and Oklahoma, 1975.

Location City	Mile	Size	Investments 1/ Through 1972		Additional As of September 1975		Major Commodities
		Acres		Dollars			
Pine Bluff, Ak		22	Federal	$2,506,000	Federal	---	Grains, Iron & Steel, Wood & Wood Products, Fertilizer, feeds, chemicals
			Local	2,906,000	Local	---	
			Private	1,750,000	Private	$7,750,000	
			TOTAL	$7,162,000	TOTAL	$7,750,000	
Little Rock, AK	112.8	210	Federal	$1,137,500	Federal	---	Steel, Fertilizer, Bauxite, Scrap Iron, Feeds, misc.
			Local	4,250,000	Local	---	
			Private	3,850,000	Private	$26,000,000	
			TOTAL	$10,546,000	TOTAL	$26,000,000	
Fort Smith, AK		22	Federal	$392,500	Federal	---	Steel, paper and misc.
Poteau, River	308.7		Local	559,500	Local	---	
			Private	---	Private	$200,000	
			TOTAL	$952,000	TOTAL	$200,000	
Muskogee, OK	396.1	275	Federal	$5,222,100	Federal	---	Pipe, steel, fertilizer, chemicals, petroleum
			Local	1,557,000	Local	$1,000,000	
			Private	---	Private	1,000,000	
			TOTAL	$6,779,100	TOTAL	$2,000,000	
Tulsa, OK (Catoosa)	448	513	Federal	$ 573,000	Federal	---	Iron & Steel, Chemicals, Fertilizer Grains
			Local	21,582,000	Local	$20,632,000	
			Private	1,500,000	Private	27,555,000	
			TOTAL	$23,655,000	TOTAL	$48,187,000	

1/ There have been no State investments made to date.
Source: 1,2 & 3.

The following sections identify ports individually. The information presented encompasses developments to date on selected ports. A previous study on port developments was completed and a report was published in August 1974 (3).

Port of Pine Bluff

Several capital expenditure programs were either in the planning or construction stages at the time of the earlier study. Included in this are the facilities of Arkansas River Terminals. Specifically, this firm has added five storage tanks, a conveyor belt system, and a fertilizer bagging plant. They also added another $50,000 to their investment via a rail line extension and a fueling station and in 1975 proposed to double the size of their transit shed (to 80,000 square feet) and to install a traveling bridge crane at a total cost of $600,000.

Within the Pine Bluff area, several other port-related developments have occurred since 1972. Valmac Corporation has completed a poultry feed processing and distribution plant. Strong Manufacturing Company has a current investment of $600,000 in a vermiculite processing facility and has a $150,000 expansion program in process. Southern Compress Company has invested approximately $2.6 million in cotton compressing facilities, including storage for 67,000 bales of cotton, rail sidings, and conveyor systems.

The Bunge Corporation Pine Bluff elevator began operation in the fall of 1968 and shipped its first barges on the navigation system in January 1969. This elevator is one of five operated by the Bunge Corporation in Arkansas. Approximately 150,000 bushels of grain can be

handled daily. The facility has a 2-million bushel storage capacity and handles approximately 4 to 5 million bushels of soybeans and wheat that is exported through the gulf coast ports. Because of its close proximity to other Bunge elevators, the majority of the grain shipped through the Pine Bluff elevator is produced within a 50 to 75 mile radius.

Cargo Carriers Inc., has a dock located downstream from the Pine Bluff port. With an investment of over $2.5 million, the firm builds barges for inland navigation. This installation was completed in November 1973. Also, in the Pine Bluff area a new facility by Steelship, Inc., is producing barges for use by the towing industry.

Little Rock Port - Public

As of December 1, 1974 the total expenditure of the Little Rock Port Authority was slightly in excess of $6 million. This is an increase of approximately $2.5 million in three years.

Two developments that were noted as forthcoming in 1972 have also been completed. The port operator, Inland River terminals, has made arrangements for equipment to handle specialized loads and a bulk handling facility is now in existance and is operated by Eastern Associated Terminals Company. At the present time, the Little Rock Port Authority is preparing to further improve the quality of the port's facilities by developing a slack water channel. However, both construction costs and completion data are not known at this time.

Little Rock-North

Little Rock Area - Private

There are numerous small, private docks in the area ranging from Little Rock to Conway. New activity in the area is limited but the Arkansas Power and Light Dock, operated by System Fuels, Inc., has been completed since 1972 with an investment of $974,000. Their facilities include unloading equipment, pipelines and storage tanks. The North Little Rock Authority is actively studying a suitable site for a port. Jones-Kirby has a port at North Little Rick; Logicou, Inc., Jeffrey Sand, and River Service Corporation all have docks in the North Little Rock area.

At Conway, Souter Construction Company is building a shop to repair its own barges. This installation is expected to be operational by mid 1976.

Keenan's Port of Dardanelle

Since the 1972 study, the only addition to the facilities at this port is a 7,000 square foot warehouse. However, the earlier study failed to include that the port has two small wharves, each approximately 25 feet by 25 feet, upstream from the main wharf and also 13,010 feet of railroad siding.

Port of Clarksville

No developments have occurred at this location. However, a new bridge crossing of the waterway has been announced. Moreover, the bridge crosses at the point on the river that is leased by the municipal

port authority for the future development, but at an elevation 50 feet above the property. This improvement in the transportation infrastructure could impact on the economic development potential of the area and consequently, be a catalytic factor in future port development.

Co-Op Port of Van Buren

The Farmers Co-Op has added a 50-ton crane and a front-end loader to its equipment at Van Buren. The expected inflow of fish meal has developed, along with an increased volume of bulk phosphate. Although coal was being loaded at this facility, the operator indicated recently that further coal movements are not contemplated and the equipment necessary for coal shipment has been removed.

H. E. Cummins Sons Construction Co. has replaced Frontier Steel Corporation as a participant in this port. Since 1972, they have added fueling and barge repair facilities including two 90,000 gallon fuel storage tanks.

Fort Smith Port - Public

Several developments have taken place at this location. Work in process in 1972, and now completed, included a concrete dock, access roads, a railroad spur and other improvements.

New projects include an additional storage warehouse (approximately 42,000 square feet). The port encompasses about eight acres, has four acres of outside storage, two docks, and mooring facilities for six standby barges. Anticipated investment in 1972 was $785,000 but actual investment now is about $1,000,000.

Fort Smith - Van Buren Area - Private

Jeffrey Point Dock is located in the eastern part of Fort Smith. This dock now has a 600 foot man-made channel, with a concrete piling, for anchoring vessels, a concrete launching ramp, and a 25-ton crane. Most of this has been completed or added since 1972.

Yaffee Iron and Metal Corporation has plans for a dock to be located just south of the Fort Smith terminal. They anticipate the cost of the dock to be $150,000 and it will be operational in 1976. The firm will use the facility to ship shredded scrap metal.

The availability of the waterway was an important consideration in the location of Bekaert Steel Wire Co. in Van Buren. They anticipate using the ports at both Fort Smith and Van Buren and are now using facilities at the Fort Smith Port to store plant construction materials. Long range plans of the company call for the construction of a private dock to serve its own needs.

Port of Muskogee

This port has undergone substantial development since the 1972 study. There have been three bond issues (1965, 1967, and 1972) related

to its development, with a total bonding of $3,375,000, or almost $2 million more than previously reported in 1974 (Source 1). Total investment in the port is now $9,796,216; with $2,475,000 of that amount coming from private sources. Three thousand six hundred feet of rail track will be completed in early 1976.

Private Ports in the Muskogee Area

Frontier Steel is the only private port in the area where significant changes have transpired since 1972. This port has added an 18,000 square foot transit shed and an 36,000 square foot storage warehouse. Substantial quantities of petroleum have begun to be shipped through this port recently.

Tulsa Port of Catoosa

As of September 1975, total investment in the Port of Catoosa was $65,553,000, with the greatest portion of the increase since 1972 coming from the private sector. Private investment in the port was in excess of $30 million in late 1975, which was almost equal to the combined public investment. A facility for loading petroleum products is under construction in 1976 and a second facility is planned.

Facilities added or completed in the last three years include a 65-ton locomotive, a grain storage facility (cost - $1,830,894), and 3,400 feet of rail line. At the present time, 116 acres of land within the industrial park have been leased and there are options on another 106 acres. In late 1975, seventeen businesses operated in the port and its industrial park.

Projects currently under construction include an outbound conveyer system and another 1.5 miles of rail track.

Water Competitive Rates. Origin and destination patterns revealed in a previous study (2) show that commodity movements occurred between the study area and all except seven states west of the Mississippi River, and all except nine states in the northeastern part of the nation. Shipments to or from distant states were not always numerous. Sometimes only one or two shipments were found. However, with shorter distances, the number of shipments tends to increase substantially. Iron and steel shipments came primarily from Illinois, Indiana, Pennsylvania, and West Virginia. Paper products came from Tennessee and Alabama, while fertilizer came largely from Florida, New Mexico or Kansas.

To illustrate the diverse and extensive nature of the flow of trade between the waterway area and the remainder of the nation, the origin or destination of commodity shipments during 1971 are presented in figure 8. Shipments to foreign countries include, Mexico, South America, Canada, Japan, Holland, India, Indonesia, and the North Sea. These export and import shipments include, large earth moving equipment, peanuts, grains, iron and steel, heat pumps and meters, connection heaters, and coal, among other things.

The average tariff rate for 194 shipments during 1971 was $15.05 per ton for rail shipments, $6.04 per ton for barge shipments, and $20.44 per ton for shipments by truck. Average shipment size was 82 tons, 910 tons, and 19 tons for rail, barge, and truck, respectively, (2).

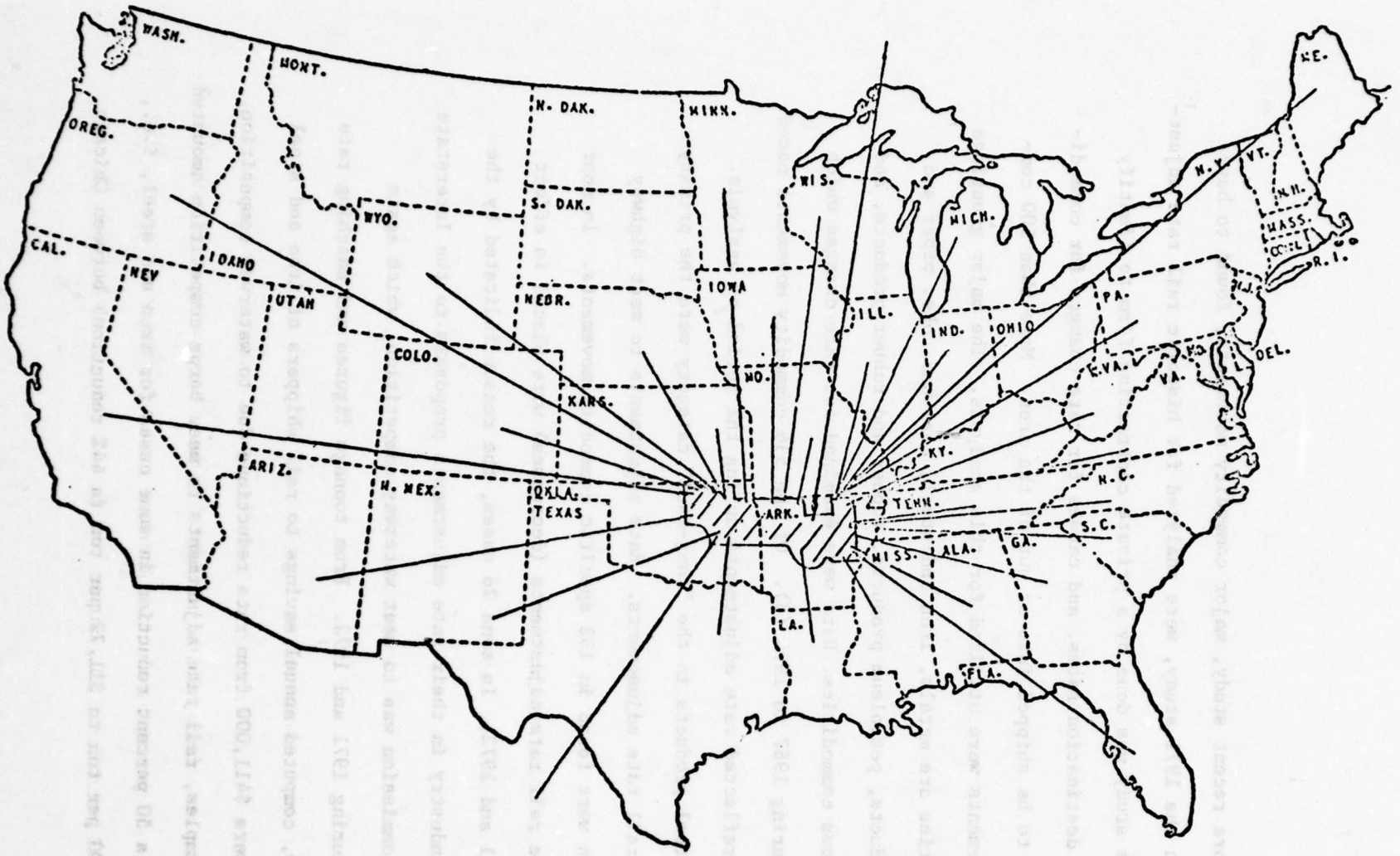

Figure 8. Origin or Destination of Commodity Shipments, Waterway Area, 1971 Source 4

In a more recent study, major commodity movements, found to have occurred in the 1971 study, were analyzed for historic rail rate adjustments. The study was done by a private contracting firm to identify origin and destination rates, and causes for rate changes for commodities known to be shipped into or out of the area. More than 500 commodity movements were utilized for this analysis. The major groupings of commodities are metals, iron and steel, coal and coke, paper and allied products, petroleum products, rubber and rubber products, and miscellaneous commodities. Data were examined for rate changes which occurred during 1967 to 1974 (5). Of the 536 commodity movements noted about 158 reflected rate adjustments during the period of analysis. Iron and steel products in the "long-haul" category were the primary source of rail rate adjustments. Rate adjustments to meet highway competition were found in 132 specific commodity movements. In most cases these rail rate adjustments (decreases) were placed in effect during 1971 and 1972. In some 26 cases, the reason indicated by the railroad industry in their rate adjustments proposals to the Interstate Commerce Commission was to meet waterway competition, which again occurred during 1971 and 1972. From tonnage figures and matching rate reductions, computed annual savings to rail shippers of iron and steel products were $411,000 from rate reductions due to waterway competition.

As examples, rail rate adjustments to meet barge competition amounted to almost a 50 percent reduction in some cases for iron and steel, i.e., from $21.00 per ton to $11.77 per ton (a 44% reduction) between Chicago,

Illinois and Muskogee, Oklahoma; coiled, rolled steel from $19.40 per ton to $9.25 per ton (a 52% reduction) Chicago, Illinois to Little Rock, Arkansas; steel rebar from Sand Springs, Oklahoma to New Orleans reduced from 68 cents per cwt to 61 cents per cwt; and steel beams reduced from 78 cents per cwt to 60 cents per cwt from Houston, Texas to Muskogee, Oklahoma.

More recently reports have been received which indicate that water compelled freight rates have resulted in large savings by farmers in moving their grain to the export market. This is substantiated by a recent Oklahoma newspaper article which indicated that a grain elevator located on the waterway could pay farmers "at least 10 cents a bushel more for their commodities than railroad and truck line elevators because of a freight rate savings." (6)

Water Tonnages. Annual tonnages moved on the Arkansas River waterway increased from 1.2 million tons to just over 6.0 million tons, Table 13. During the 1968 to 1974 period tonnages increased gradually from year to year except during 1973 in which the tonnage dipped slightly. Inbound tonnages are generally upward with the largest volume being achieved during 1974 at slightly in excess of 1.7 million tons. Outbound shipments have varied through the years, the greatest volume being shipped out during 1972 when the volume reached in excess of 900,000 tons. As a brief reminder, the waterway was not opened to Catoosa until 1971,

so the waterway is still in its infancy. Total ton-miles show a relatively strong consistant upward trend increasing from about 3,000,000 ton-miles to more than 450,000,000 ton-miles in 1974, except for 1972 when the ton-miles reached a high of slightly more than 520,000,000.

Table 13. Annual Tonnages Shipped on the Waterway, Arkansas and Oklahoma, 1968-1974.

Year	Total Tonnage	Inbound	Outbound	Total Ton Miles
1968	1,238,300	600	20,516	2,928,851
1969	2,905,800	736,648	229,406	119,259,821
1970	3,994,800	1,129,048	301,916	183,387,076
1971	4,294,000	920,444	480,367	256,863,438
1972	5,337,400	1,037,179	927,161	520,887,271
1973	4,955,800	1,544,499	533,357	338,623,935
1974	6,000,400	1,742,168	690,857	451,108,827

Source: 7

There are general upward trends in tonnage of petroleum, grains, chemicals and fertilizers, iron and steel. Variations in tonnage of ores and minerals have been great, from almost 900,000 tons in 1970 to only 91,000 tons during 1972. Also, quantities of coal and coke have ranged from about 9,000 tons in 1970 to more than 500,000 tons in 1972. Commerce moved on the waterway in 1973 decreased slightly due probably to the high high water conditions during the year which restricted towboat operations for significant periods of time.

The composition of the total tonnages moved on the waterway are shown in Table 14. The broad commodity groups are aggregates, petroleum, grains, chemicals and fertilizers, ores and minerals, iron and steel,

coal and coke, waterway improvement materials, and miscellaneous materials. Much of the tonnages each year is composed of aggregates and waterway improvement materials, which is about one-half the total tonnage.

Table 14. Composition of Tonnages Shipped on the Arkansas River Waterway, Arkansas and Oklahoma, 1970-1974

Commodity group	Years				
	1970	1971	1972	1973	1974
Aggregates	1,704,516	2,014,890	2,456,181	1,992,974	2,187,323
Petroleum	-	-	180,769	644,225	639,866
Grains	437,366	476,124	564,944	555,957	704,874
Chemicals and Fertilizers	164,077	298,837	425,617	361,768	362,394
Ores and minerals	879,609	331,810	91,352	285,019	530,276
Iron and steel	93,663	226,092	309,785	176,525	254,542
Coal and coke	9,041	42,628	533,478	154,085	198,080
Waterway improvement materials	676,276	778,402	586,796	630,158	950,076
Miscellaneous	30,234	125,265	188,448	155,078	173,012
Totals	3,994,782	4,294,048	5,337,370	4,955,789	6,000,443

Source: 8

FOOTNOTE SOURCES

1. Prepared by University of Arkansas, Fayetteville, AK.

2. Data assembled by Corps of Engineers, Navigation Charts, July 1976.

3. Regional Response through Port Development: An Economic Case Study on the McClellanKerr Arkansas River Project, August 1974, IWR Report 745.

4. Discriminant Analysis Applied to Commodity Shipments in the Arkansas River Area, August 1974, IWR Report 74R2.

5. Rate Adjustment Analysis, McClellan-Kerr Arkansas River System, June 1975. Draft Report submitted by Southwestern Division, Corps of Engineers, Dallas, Texas to Institute for Water Resources, Ft. Belvoir, VA.

6. Tulsa Daily World, Monday, January 12, 1976.

7. Waterborne Commerce Statistics, 1968-74.

8. Waterborne Commerce Statistics, 1970-74.

CHAPTER V

INDUSTRIAL DEVELOPMENT

A large number of factors affect the location of manufacturing establishments. These factors can range from nearness to market and/or raw materials to such esoteric considerations as proximity of cultural attractions. Among the various factors affecting manufacturing plant location is the extent to which a multimodal transportation complex has been developed in an area. Certainly, in many instances a sophisticated transportation system has been the factor responsible for the development of a manufacturing complex employing thousands of persons and contributing millions of dollars to the area's income.

When the waterway was completed across eastern Oklahoma and the state of Arkansas, it resulted in economic growth and provided a link with other inland waterways and gulf ports. This inexpensive mode of transportation provided a key element necessary to make these areas of Arkansas and Oklahoma a more competitive location compared to other areas of the nation. Manufacturing activity certainly has grown in the areas of Arkansas and Oklahoma contiguous to the waterway since its completion. The extent to which this growth is attributable to the existence of the waterway has not yet been fully defined.

The factors affecting the growth of manufacturing in Oklahoma and Arkansas contiguous to the waterway is presented here. The role of the waterway at the present time and its effect on growth in the study area is discussed as an integral part of this section of the report. The Oklahoma counties included in this area are: Haskell, LeFlore, Muskogee,

Rogers, Sequoyah, Wagoner and, because of its proximity to the Port of Catoosa, Tulsa. The Arkansas counties in this area are: Pulaski, Sebastian, Yell, Faulkner, Jefferson, Johnson, Crawford, Pope, Franklin, Arkansas, Conway, Logan, Desha and Lincoln.

A total of 497 manufacturing establishments located in these counties are either new to the area or have expanded their operations. Of these firms, 29 percent (144 firms) have expanded their operations while 41 percent (204 firms) which located in the area after 1969, have undergone expansion. The remaining 30 percent (149 firms) have only located in the area in the past six years.

This growth in manufacturing activity in the counties contiguous to the waterway includes most types of manufacturing.

Factors Affecting Location or Expansion. An examination of the factors which have contributed to the manufacturing growth in the study area reveals several important features, including the role played by the waterway. The factors considered by these firms are arrayed in Table 15.

It is apparent from the data shown in Table 15 that the availability and cost of labor, land costs, accessibility to markets, and raw materials availability were the overriding considerations in the locational and the expansion decisions reached by these firms. Of somewhat lesser yet important concern were such other factors as taxes, transportation rates, unionization, construction costs, and water transportation.

Table 15. Factors Affecting Locations and Expansion of Manufacturing Plants in Selected Counties, Waterway Area, 1975

Factor	Percentage of Plants Indicating Importance		
	Oklahoma	Arkansas	Total
Availability of Labor	49	52	51
Labor Costs	46	48	47
Accessibility to Markets	46	45	45
Land Costs	48	40	43
Accessibility of Raw Materials	42	40	41
Personal Preference of Management	39	40	40
Local Tax Structure	39	39	39
Living Conditions	36	41	39
Low Transportation Rates	39	35	37
Construction Costs	30	39	36
State Tax Structure	36	35	35
Union vs Non-Union Labor Force	36	32	34
Anticipated Changes in Access to Raw Materials	33	31	32
Low Absenteeism	33	30	31
Community Willingness to Finance Investment	30	31	31
Anticipated Changes in Markets	33	28	30
Access to Water Transportation	12	26	21

Source: 1

Accessibility to Water Transportation. Results of a sample survey of manufacturing establishments located along the waterway indicate that about eight percent of the firms which have located or expanded in the area directly attribute their change to the waterway. Another 21 percent assigned a wide variety of factors but did not attribute their change to any particular factor while 71 percent indicated that the waterway was not considered to be a relevant factor. These responses were elicited by directly questioning the firms surveyed as to the influence of the waterway on their location/expansion decisions. Approximately 83 percent of the firms, which considered the waterway as a key factor, indicated that its possibility for future use was of greater importance. An analysis of the types of transportation used by the various firms surveyed reveals that five percent (26 firms) utilize the waterway to a significant degree to obtain their raw materials. However, another five percent (26 firms) also ship out products by barge.

As noted in Table 15, 21 percent of the firms did consider the waterway as an asset when making their location or expansion decision. It is interesting to note that, while access to the waterway was not frequently a prime consideration, the existence of low transportation rates was of considerable importance to 37 percent of the firms.

Approximately five percent of the firms, which considered the waterway an important factor in their decision to locate or expand in the study area, placed greatest emphasis on the recreational aspects of the waterway.

Of these, less than one percent brought their labor force with them when they moved but recruited from local sources.

Of the 21 percent of the firms which considered the waterway as a direct or indirect asset in reaching their location/expansion decision, 12 percent have used the Waterway for any purpose less than they originally contemplated. The remaining nine percent have used it about as was originally intended.

Finally, the firms surveyed were asked to comment on those areas of their activity which have been affected by the waterway. The most important impact has been on the markets of these firms while lesser impacts have been felt on pollution control, security and operating costs. Only three percent of the firms surveyed were of the opinion that their product lines had been affected by the waterway.

Manufacturing Plants Using the Waterway. The manufacturing plants which stated that the waterway directly influenced their plant location are generally metal fabricators and publishers of printed materials. The raw materials used by these firms consist principally of iron and steel sheets, bars, billets and forms and newsprint. The resulting products are heavy. These firms were located in major manufacturing centers such as Tulsa, Little Rock and Fort Smith.

These plants employ from five to 680 persons all of whom were locally recruited, and they report sales volumes ranging from $500 thousand to $45 million. The basic reasons given by the managers of these plants for selecting their present locations included the existence of a good labor force; suppliers of certain needed raw materials were near at

hand, the land costs were reasonable; buildings were available; their markets were near; and a good transportation complex was available to them. Only 39 percent of these firms occupied an existing building when they located here and have not expanded since moving. The remainder have built new building and have since expanded as their activities have grown. All expansions occurred between 1971 and 1975.

Impact by State. The impact of the waterway on the manufacturing sector of the economy has been felt to a greater degree in Arkansas than in Oklahoma. This situation is not surprising for at least two reasons: first, the waterway has been completed and operational in Arkansas for a longer period of time than has been the case in Oklahoma and second, more of the waterway is located in Arkansas than in Oklahoma.

In both states, the heaviest concentrations of new plants and plant expansions have occurred in and near the larger cities. This development, too, is not unexpected since the larger cities, besides being more aggressive, represent larger labor pools and markets. And, in addition, these cities generally have better manufacturing and transportation facilities.

Arkansas

A total of 374 manufacturing plants have either located or expanded in Arkansas since 1969. Of these, 152 were in Pulaski County (Little Rock) and 81 were in Sebastian County (Fort Smith). Other significant concentrations were in Faulkner County (Conway), Johnson County (Clarksville) and Crawford County (Van Buren), Table 16.

Table 16. Location or Expansion of Manufacturing Plants Selected Counties, Waterway Area, Arkansas, 1969-1975

County	Number of Establishments
Pulaski	152
Sebastian	81
Faulkner	31
Jefferson	19
Johnson	16
Crawford	15
Pope	12
Franklin	9
Arkansas	9
Conway	8
Logan	8
Desha	8
Yell	5
Lincoln	1
Total	374

Source: 1

Most of these firms gave availability of labor as the most important factor in their decision to expand or relocate. Labor costs were also cited by many as an overriding feature of the area. More than one-fourth (97 firms) consider the waterway as an asset and thus having exerted any influence on their relocation expansion decision. Furthermore, some 35 percent considered low transportation rates important.

Oklahoma

A total of 123 manufacturing establishments in the seven Oklahoma counties are located along or near the waterway. Of these, 94 located in Tulsa County because of the facilities available in the City of Tulsa. Muskogee, the second largest county in the area, also received significant benefit from the waterway as 11 plants either expanded or relocated to that county. As was the case in Tulsa, the facilities available in Muskogee were the causes underlying these plant changes. The distribution of these locations and expansions by county is shown in detail in Table 17.

In Oklahoma, as in Arkansas, availability and cost of labor were two of the main causes for relocation and/or expansion. Land costs, accessibility to markets and accessibility to raw materials also weighed heavily in these decisions. Access to water transportation was of significance to some 12 percent of the firms, principally for future planning purposes.

The importance of the waterway to Oklahoma manufacturers (as measured by the degree to which accessibility to water transportation played a

Table 17. Location or Expansion of Manufacturing Plants Selected Counties, Waterway Area, Oklahoma, 1969-1975

County	Number of Establishments
Tulsa	94
Muskogee	11
Sequoyah	9
LeFlore	3
Rogers	3
Haskell	2
Wagoner	1
Total	123

Source: 1

role in plant location/expansion decisions) was far less than was the case in Arkansas. This may be attributable again in part to the greater length of time that the waterway has been operational in Arkansas.

Modes of Transportation Used. The raw materials purchased and finished products shipped by the manufacturing establishments along the waterway vary widely from agricultural commodities and processed products to highly sophisticated instruments. The largest volume of raw materials received by these plants are metals and metal products. Newsprint also represents a large volume of the freight moving into the area while outbound movements of manufactured products by all modes are dominated by clothing, machinery, chemicals and food products.

Raw Materials

Those manufacturers surveyed, who have located or expanded along the waterway, are preponderantly users of truck transportation as their primary mode for inbound shipments. In fact, 97 percent use trucks to haul raw materials to their plant. Of these, 69 percent use trucks for at least 90 percent of inbound shipments. A total of 38 percent use rail as an inbound mode. However, rail is considered as a supplement to trucking by most of the surveyed manufacturers, and only one producer relies solely on rail as a means for receiving raw materials. A second producer receives an estimated 90 percent of his raw material by rail.

Water transportation is used by six percent of the producers surveyed. One of these producers relies on water for as much as 90 percent of his

shipments. The remaining firms using water receive 60 percent or less of their inbound materials by water.

Air shipments of raw materials involve only four percent of the manufacturer along the waterway. Those using air as a mode rely on it for less than five percent of their inbound shipments.

Finished Product

As was the case with inbound shipments, trucking represents the principal means by which finished products are moved to the market. A total of 95 percent of the new or expanded plants along the waterway move some portion of their finished product to market by truck. More than 71 percent of these plants ship 90 percent or more of their products by truck. Another 11 percent ship between 50 percent and 89 percent by truck and the remaining seven percent ship less than half of their product to market by this means.

Rail shipments of finished products account for 27 percent of the total. However only ten percent shipped as much as half of their product by this mode.

Five percent of the firms use water for shipping finished products to the market. All of these firms shipped less than five percent of their product by water. The use of air transportation for moving finished products to market has become a relatively important element, and, currently, 15 percent of the new or expanded plants along the Waterway use this mode in some degree. While most firms rely on it for less than ten percent of their total outbound shipments, one relies on air for all shipments to market.

Transportation Decisions. For the most part, local plant management determines the modes of transportation to be used both in acquiring raw materials as well as in making distribution of the finished product. In fact, management of 85 percent of the new or expanded plants along the waterway make transportation policy decisions. These decisions are based on costs, size of shipment, length of time to delivery, size and weight of product, value of product, as well as, accessibility of various modes. Manufacturing along the waterway is characterized currently by firms handling small and/or lightweight products which do not lend themselves well to large barge shipments. Another consideration could be that because of the inland location of these plants and their distance--by water--from larger market areas, delivery times may be excessive in relation to competitors located elsewhere when shipping by barge. Logically, local management, whether of a branch office or the main plant, would wish to take advantage of lower costs wherever offered, other factors being equal.

It is of note that only ten percent of the plants which have expanded or relocated along the Waterway have inflexible transportation policies. The remainder review their policies with some regularity and thus are adaptable to changes in the structure of the area's transportation complex.

FOOTNOTE SOURCES

1. Special Survey, Center for Economic and Management Research, University of Oklahoma.

Chapter VI

AGRICULTURAL DEVELOPMENT

The Economic Setting. The period 1969 to the present has been one of unparalleled change in American agriculture. The major element of change has been the dynamic and dramatic growth of agricultural exports over that period. After essentially static export levels over the previous decade, American farm exports have grown from a dollar volume of $5.7 billion in 1969 to $12.9 billion in 1973 and $21.6 billion in 1975, figure 9. This growth in exports has generated a major turnabout in farm prices and farm income in the U.S. and in the area of the Waterway.

Soybeans and soybean products, wheat and flour, and the feed grains are currently the nation's three leading agricultural exports. During both fiscal 1974 and 1975 exports of each of these groups exceeded $4 billion. During the same years, the value of cotton exported exceeded $1 billion annually and rice exports totaled just under $1 billion. Soybeans and soybean products, wheat and flour, feed grains, cotton, and rice are of major importance in the area of the waterway. And dynamic changes have taken place in the cropping patterns of the region during the 1969-74 period.

Even though the growth in farm exports has generated a major turnabout in U.S. farm prices and farm incomes, the increase in international trade in American feed grains and soybeans had generated some enormous impacts upon the feed using livestock and poultry sectors. Both of

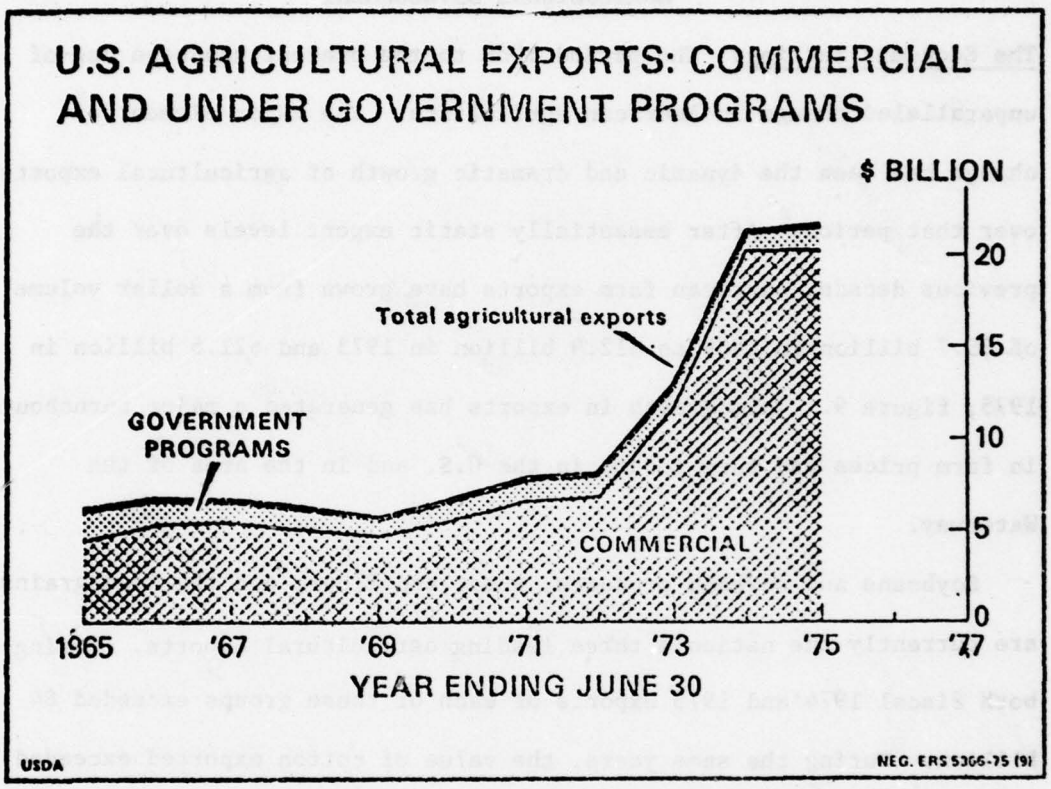

Figure 9. U.S. Agricultural Exports, Value in Dollars, 1965-1975.
Source: 1

these sectors are of major importance in the Waterway area. These impacts are particularly noticeable since the calendar year 1972 when the massive sale of American wheat to Russia depleted the large American grain inventory. The subsequent increase in feed prices reduced U.S. broiler production by about 3 percent and fed cattle marketings by 13 percent between 1972 and 1974. The result of the reduction in cattle-on-feed was a continuing buildup of cattle inventories on farms and ranches. By the end of 1974, U.S. inventories were 10 million head, eight percent larger than inventories at the end of 1969.

Potential Waterway Impacts. Clearly, the agricultural trends of a region must largely reflect trends at the national and international levels. However, there are reasons to expect that major public investments, such as those involved in the McClellan-Kerr Waterway, might modify or accentuate trends in the agricultural development of the Waterway region. The impact of the Waterway on the agriculture of th area, through product and resource prices, constitutes a specific example. This would include nonagricultural competition for land and other agricultural resources as well as changing input prices as a result of changing transportation costs. Similarly, product prices could be affected through reduced marketing costs arising from lowered transportation costs. In view of the potential for change in the region's agriculture from the Waterway project, it is important that a formal picture of the current agriculture of the area be developed. Such information is presented in the sections which follow.

Changes in Agricultural Production. Generally, the acreage in farms in the agricultural impact area of the McClellan-Kerr Waterway has not changed since 1969, figure 1, page 8. However, the use to which that acreage has been put and the productivity of that acreage has changed significantly. Cotton acreage has been reduced in favor of soybean production in the Oklahoma portion of the Waterway impact area, and other crops have been replaced by increased acreages of soybeans and rice in the Arkansas portion. Since rice and soybeans are both major items in the recently increased volume of international trade in American farm products, and since the waterway has given agricultural producers in the waterway area ready access to international markets, these changes are entirely understandable.

In the livestock and poultry sectors, broiler production increased by about 16 percent in the Arkansas portion of the Waterway area between 1969 and 1973. The 1969-74 increase in broiler production in the Oklahoma section of the waterway area was 67 percent. Cattle inventories over the 1969-74 period increased by 32 percent in the Oklahoma portion of the impact area and by 51 percent in Arkansas.

It is clear that the nonfarm economic development along the Arkansas River has in no way inhibited the level of agricultural production, even though the general economic environment has generated some change in the relative importance of alternative agricultural enterprises. However, there have been some significant developments at points along the river that are based upon the agricultural production and the availability of water transportation.

Two Case Studies of Agricultural Related Facilities. Two operations, the grain elevator near Wagoner and the fertilizer producing and handling subsidiaries of the Williams Co. in Tulsa, were analyzed in detail. These operations are illustrative of agriculturally related activities prompted by development of the waterway.

The Wagoner Elevator

This elevator, owned by Guthrie Cotton Oil, began operation in 1972 with a 500,000 bushel capacity. The elevator buys, sells and stores soybeans and wheat. Current storage capacity is 1,000,000 bushels. Approximately 100,000 bushels can be handled (unloaded, moved into storage bins, etc.) in a single day. In the fiscal year beginning April 30, 1974 the elevator handled 1,350,000 bushels of soybeans and 800,000 bushels of wheat.

The elevator buys soybeans and wheat primarily in an eight-county area in and around Wagoner county. In the area immediately surrounding the facility, almost 100 percent of the grain, especially soybeans -- moves to the elevator. The percentage of the production from outlying counties declines but remains significant. Purchases from producers in counties 150-175 miles away, such as Pottawatomie and McCurtain counties, can be documented.

Soybean production in Oklahoma has increased more rapidly in recent years than in the U.S. as a whole. In the Wagoner area, growth has been

even more dramatic. Records of soybean production data for the U.S. Oklahoma and an eight county area in and around Wagoner county appear in Table 18. During the 1969-74 period, production increased 45 percent in Oklahoma compared to 9.5 percent for the U.S. The Wagoner area constitutes a growing percentage of Oklahoma production. In 1974 Wagoner and Muskogee counties (Muskogee county is just south of Wagoner) ranked first and second respectively as soybean producing counties in the state, up from second and fourth in 1969.

Table 18. Soybean Production in the U.S., Oklahoma and Wagoner Area*, 1969-74

Year	U.S.	Oklahoma	Wagoner Area	Wagoner Area as % of Oklahoma
		(million bushels)		(%)
1969	1126.300	3.468	1.250	36.0
1970	1123.700	3.330	.991	29.8
1971	1169.400	3.505	1.091	31.1
1972	1270.600	3.570	1.150	32.2
1973	1547.200	4.600	1.759	38.2
1974	1233.400	5.037	1.991	39.5

*Includes Wagoner, Mayes, Rogers, Tulsa, Okmulgee, McIntosh, Muskogee and Cherokee counties.
Source: 2

The increases in production have been paralleled by strong prices. Season average soybean prices for the U.S. and Oklahoma during the 1969-74 period is revealed in Table 18. Oklahoma prices had moved to from 92 percent of the U.S. price in 1969 to 99 percent by 1974. Prices in the Wagoner area have increased even more. The Wagoner elevator, with its access to barge traffic, typically offers 10 to 20 cents per bushel

more than nearby elevators in Muskogee. Elevator officials attribute this to their access to barge traffic, a shipping alternative which is not presently available to the Muskogee elevators.

Table 19. Seasonal Average Prices for Soybeans, U.S. and Oklahoma, 1969-74

Year	U.S.	Oklahoma	Oklahoma as % of U.S.
	($ per bushel)		(%)
1969	2.33	2.15	92
1970	2.84	2.65	93
1971	3.01	2.80	93
1972	4.13	3.60	87
1973	5.57	5.35	96
1974	6.69	6.65	99

Source: 3

Influence on wheat prices has been less dramatic. The area in and around the Wagoner facility is not an important wheat producing area. For the wheat which is handled, the Wagoner elevator buys hard red winter which means cash prices are tied to the Houston-Galveston export market. However, wheat moved by barge must go to New Orleans, an export market influenced by the soft wheats of the midwest and corn belt states. The New Orleans export price is often below the Houston price which partially offsets any competitive advantage the Wagoner facility has due to its location on the waterway.

The Williams Co.

There are two subsidiaries of Williams Co. active in agricultural activities in the vicinity of the McClellan-Kerr waterway. Agrico is a fertilizer producing subsidiary located at Verdigris, Oklahoma (near Catoosa). Willbros is a terminal and fertilizer distribution facility located at Catoosa.

Agrico. The Verdigris plant involved an initial investment of $60 million and began operation during 1975. Annual capacity is 425,000 tons of anhydrous ammonia. Plans for a second 425,000 ton plant were announced in April of 1975.

The Verdigris location was selected because of ready access to natural gas, access to the pipeline distribution system into the midwest controlled by another subsidiary of Williams Co. and access to the waterway. Although the waterway is not currently used to ship the finished products (primarily nonpressure nitrogen solutions), Williams Co. officials cite advantages which accrue from their location. If the plant shifts to the production of a product such as feedgrade urea, barge traffic would be used. Further, manufacturing aids such as nitric acid could be brought in by water if normal supply channels were to be disrupted.

Distribution from the Verdigris plant by rail and truck extends west, southwest and northwest of the plant. The area reaches into northern Texas, most of Oklahoma and into south central Kansas. Any investment and/or agriculturally related development stimulated by the Verdigris plant will be largely in the distribution area. For example,

fertilizer dealers in Enid, Kingfisher or other local points will be more inclined to invest in storage tanks, distribution equipment, etc. because of the volume and availability of product at the Verdigris location.

Willbros. In operation since 1972, volume of solid fertilizer brought in on the waterway by the Willbros facility are shown in Table 20. Volumes brought in by barge were down in 1973 and 1974 due to high water and related problems along the waterway and due to the short supply of nitrogen, prompting direct shipments which often bypassed the warehousing function performed by Willbros.

Table 20. Volumes of Solid Fertilizers Shipped on the Waterway by Willbros, 1972 - 1975.

Year	Volume (tons)
1972	80,000
1973	45,000
1974	35,000
1975 (January-October)	36,000

Source: 4

The distribution area for the Willbros facility is essentially the same fanshaped area outlined earlier for Agrico. The primary products are Urea and DAP (18460) which come up the waterway from plants in Donaldsonville, La. and Blytheville, Ark.

The implications of Willbros inshipments by barge to the price of fertilizer, (cost to area farmers) is difficult to isolate. Price to the local distributor is on a "delivered basis." In general

this involves a combination of production costs, producer operating margins, and a reflection of the "average freight experience" of the shipping producer. Freight costs often approximate one-third of the final delivered price. Since barge freight costs are typically lower, and given the highly competitive nature of the fertilizer business, the availability of barge traffic could mean a lower delivered price than would be the case without barge movement.

Feed Grain Prices. A further change that has been observed over the 1969-74 period is in the interregional structure of feed grain prices. While feed grain prices have increased dramatically in all areas since 1969, the increases have not been equally distributed among regions. The nation's lowest average cost feed grains were in the Montana-North Dakota area in the 1968-70 period. Arkansas, on the other hand, had a feed grain cost 23 percent above the nation's average, figure 10.

While the U.S. average price of feed grains had increased by 160 percent between 1969 and 1974, the price in Arkansas had increased by only 108 percent, giving Arkansas a feed grain price that was actually below the national average, figure 11. This was at least a part of the reason for Arkansas increasing its share of broiler production from 14.9 percent in 1969 to 17.3 percent in 1972, and maintaining a share of 16.1 percent in 1974 when the entire broiler industry was under great economic stress. Within the state of Arkansas, the waterway impact area reduced its share of total Arkansas broiler production until 1972 when the dramatic increases in feed costs began. After this cost increase,

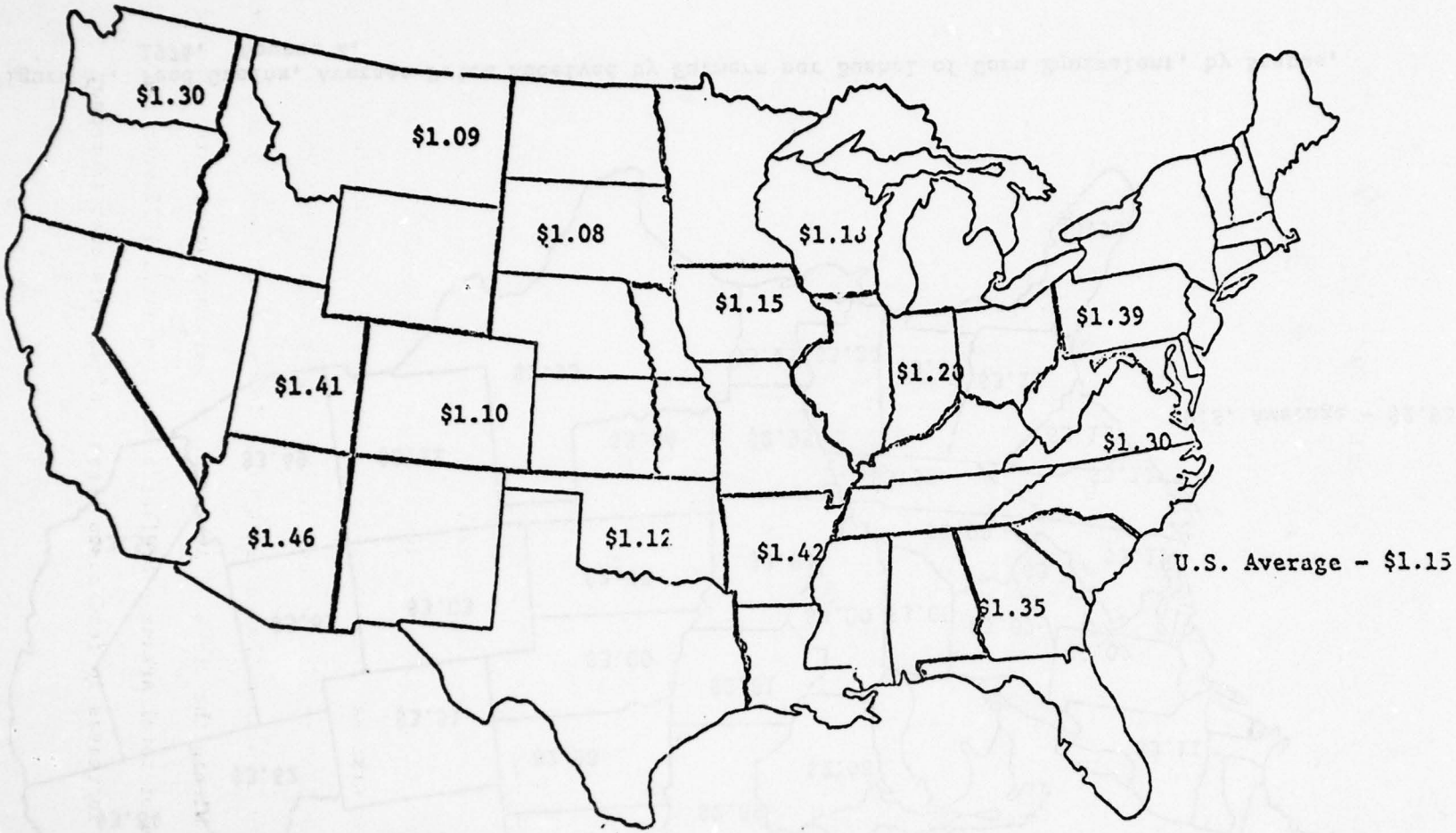

Figure 10 Comparative Regional Feed Grain Costs (Average Price per Bushel of Corn Equivalent Received by Farmers), 1968-1970 Crop Years. Source 5.

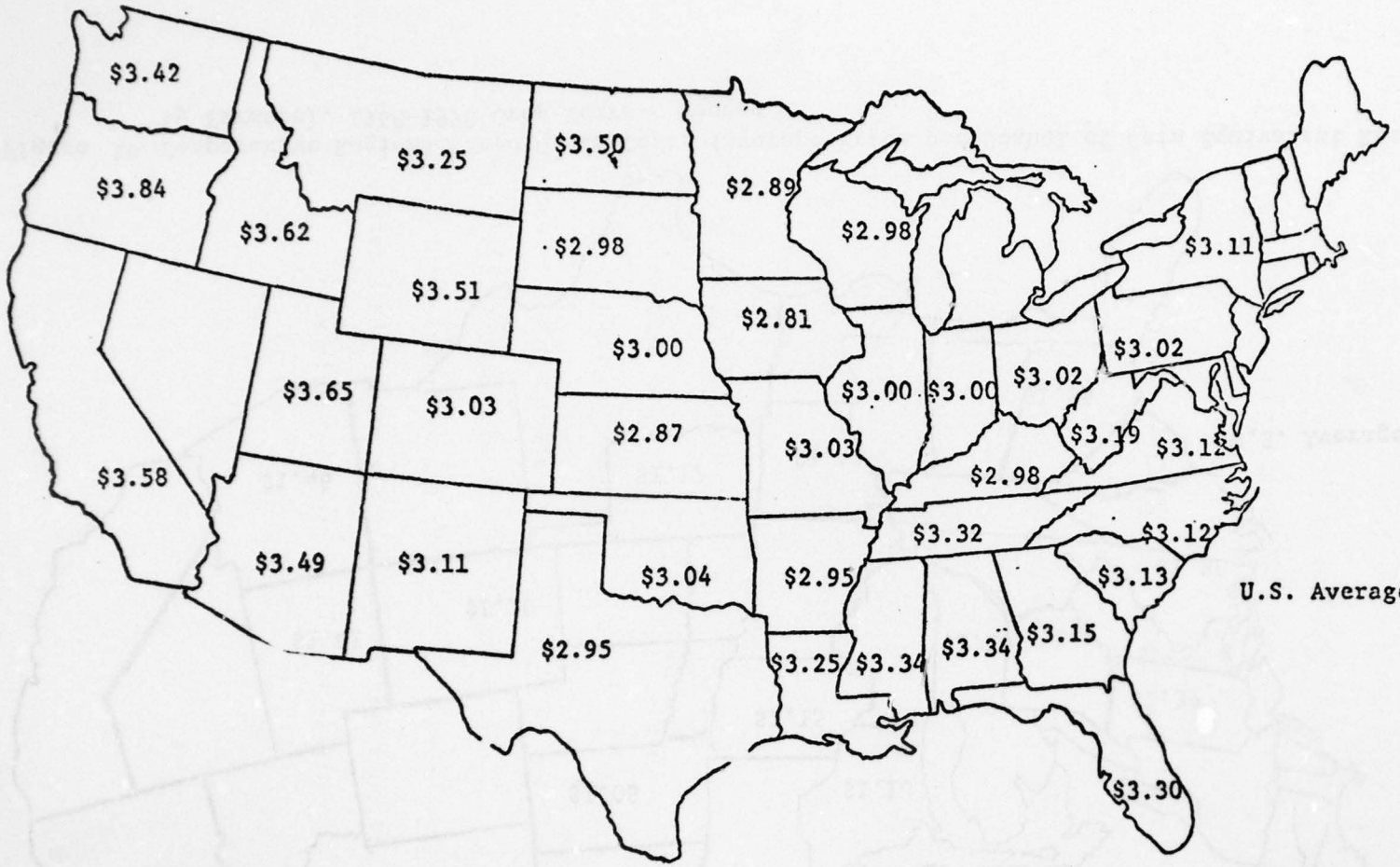

Figure 11. Feed Grains, Average Price Received by Farmers per Bushel of Corn Equivalent, by States, 1974. Source 2.

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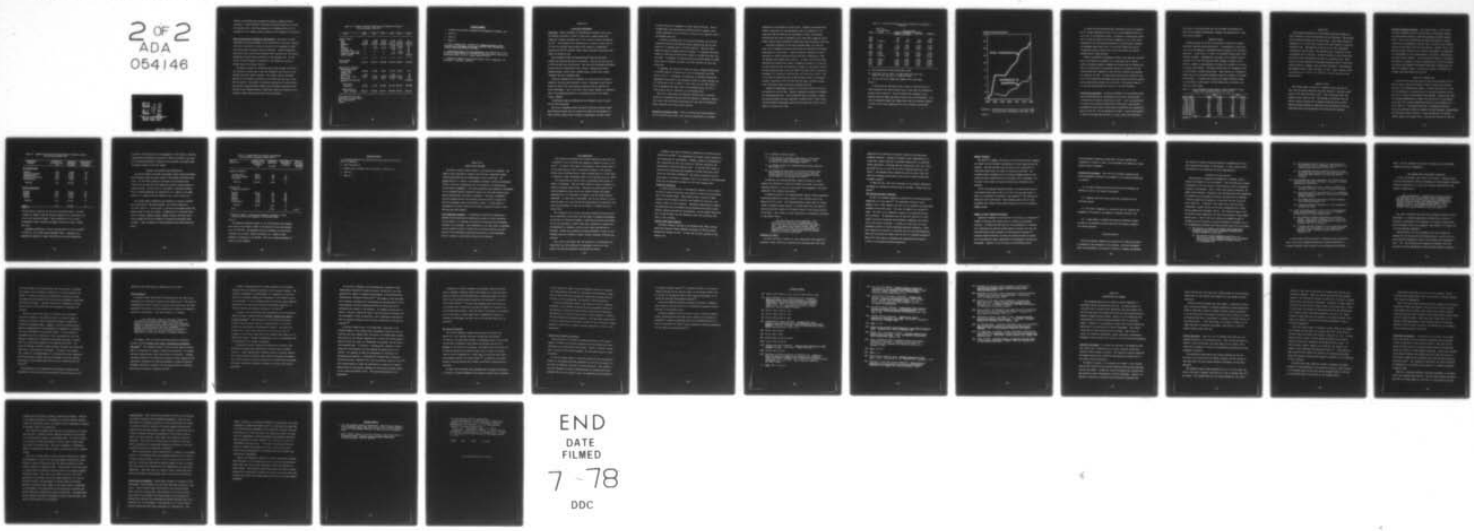

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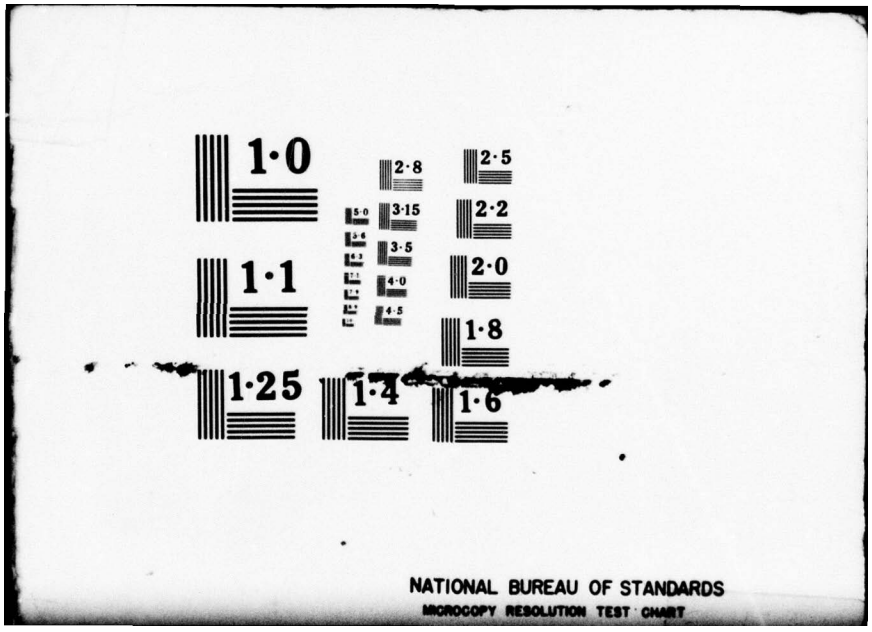
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however, the Waterway area increased its share of Arkansas broiler production. Within Oklahoma, virtually all broiler production is within the waterway area. Since the opening of the Oklahoma portion of the waterway in 1971, Oklahoma broiler production has increased by 53 percent.

Flows of Agricultural Products on the Waterway. The general economic environment and the development of the availability of waterway transportation have interacted to create the incentive for investment in agricultural business facilities along the waterway. Further interaction among these three factors have generated some incentives for the observed adjustments in agricultural production in the waterway area. The net results of these changes are reflected in the changes in waterborne freight along the waterway, Table 21.

The massive increase in waterborne agricultural freight in 1971 and 1972 was due in a major way to the 1971 opening of that portion of the waterway above Fort Smith, Arkansas. For example, much of the wheat shipped on the waterway is produced in the areas north and west of the Port of Catoosa. The decline in waterborne agricultural freight (indeed, the decline in all waterborne freight on the waterway) resulted for the most part from extended periods of high water along the waterway and the related problems resulting from these flood conditions.

Table 21: Volumes of Agriculturally Related Commodities Shipped by the Waterway, 1969-1974

Item	1969	1970	1971	1972	1973	1974
Grains & Feeds						
Corn	2,456	4,696	28,916	51,188	5,611	NA
Wheat	8,781	13,346	18,307	28,445	49,210	123,277
Soybeans	319,878	419,324	428,901	480,673	478,774	423,510
Rice	--	--	--	4,638	22,362	NA
Molasses	--	2,348	12,165	19,452	8,846	NA
Oilseeds, nec	--	--	--	958	--	NA
Grain Mill Prod., Nec.	--	--	--	--	2,664	NA
Prepared Animal Feeds	--	--	--	1,400	1,400	NA
Other Grains[1/]	--	--	--	--	--	155,225
Total Grains and Feeds	331,115	439,714	488,289	586,484	568,867	702,012
Agricultural Chemicals						
Nitrogenous fertilizer (mfd)	10,880	29,995	54,087	81,523	52,623	NA
Potamic Fert. Materials	1,261	--	--	1,263	--	NA
Fert. & Mat., nec.	12,887	33,413	95,697	183,369	132,643	NA
Phosphates	--	13,794	18,474	17,350	4,661	NA
Chemical Fertilizers[2/]	--	--	--	--	--	199,300
Total Agric. Chemicals	25,028	77,202	168,858	283,505	189,927	199,300
Grand Total of Agric. Freight	356,143	516,916	656,547	869,989	758,794	901,312

1/Includes corn and rice.
2/Includes all fertilizers.
NA - Not available.
SOURCE: 7

FOOTNOTE SOURCES

1. Prepared by contractor, Oklahoma State University, Stillwater, OK.

2. Same as 1.

3. Same as 1.

4. Same as 1.

5. John W. Goodwin and J. Richard Crow, Optimal Locations of Beef Production and Processing Enterprises, Bulletin B-707, Oklahoma Agricultural Experiment Station, July 1973.

6. Agricultural Prices, and Crop Production, both publications of the Statistical Reporting Service and the Crop Reporting Board, Agricultural Marketing Service, U.S.D.A., Annual Issues for 1974.

7. Waterborne Commerce of the United States, Corps of Engineers, U.S. Department of the Army, 1969-1974.

Chapter VII

RECREATION DEVELOPMENTS

Facilities. Public attendance at the lakes and recreation areas along the waterway continued to climb in recent years, despite high river stages and flooding throughout much of the recreation season during 1973 and 1974. The Navigation Plan features had 14.3 million visitor days in 1974 and 15.8 million visitor days in 1975, which is a significant increase over the 10.4 million visitor days of use when the waterway was opened to Catoosa in 1971.

Many recreation areas are being developed along the shoreline between the mouth and the head of navigation. They vary in size from 10 to 900 acres and total 14,000 acres. Each site may be equipped differently but most will be equipped with picnic tables, fireplaces and grills, camping grounds, trailer sites, parking spaces, potable water supply, restrooms, and boat launching ramps.

Along the Arkansas River in Arkansas, the Corps now has 56 parks in operation, and nine parks reserved for future development, while others (state and local) have seven parks in operation and two reserved for future development. One of the Corps' future parks, Hartman, on Dardanelle Lake, is now being developed by a cost-sharing contract with Johnson County, Arkansas.

In Oklahoma, along the Arkansas and the Verdigris rivers, 39 parks are now fully developed.

The Corps of Engineers builds recreation facilities oriented toward water based activities and has recently has added such developments as nature trails, hiking trails, children's playgrounds, and sports areas

at some locations to complement the water based activities. The developed public use areas along the channel provide a complete recreational experience for the millions of visitors of all ages who come to the waterway each year.

To further the opportunity for hunting and fishing, the Corps has cooperated with State and Federal wildlife agencies and has set land aside for or licensed lands to wildlife agencies. There are three Federally operated refuges along the waterway. In Arkansas, Holla Bend Refuge of 4,000 acres and White River Refuge of 113,000 acres have been set aside. In Oklahoma, the Sequoyah National Wildlife Refuge of 20,800 acres total is Federally operated, with about one-half the total area being land.

In Arkansas, the Corps has licensed the state to manage 50,000 acres of wildlife reserve, 42,000 acres at Pool 10 (Dardanelle) and 8,000 acres at Pool 2. In Oklahoma, the Department of Wildlife Conservation administers three areas on the navigation system for public hunting, one of 1,690 acres at Pool 15 (Robert S. Kerr Lake), one of 3,961 acres at Pool 16 (Webbers Falls Lake), both on the Arkansas River, and one of 2,197 acres at Pool 17 (Chouteau) on the Verdigris River.

When all of these areas are operating, 185,581 acres of land and water will be managed by Federal and State agencies to maintain, nurture and attract fish and wildlife populations for use, with this operation being compatible with other project purposes.

Recreation Attendance Trends. Water and related land based recreation such as camping around lakes, have increased significantly in economic

importance on the Waterway in recent years. Oklahoma and Arkansas have become a water mecca for recreationists, with the completion of the lakes and locks and dams and the development of public recreational facilities by the Corps of Engineers and by other public agencies (State Parks), and by private operators leasing water areas for marina facilities.

Recreation attendance at the three upstream lakes, the locks and dams, and at developed recreation areas along the waterway has increased dramatically in recent years. Annual visitations, measured in visitor days were 1.4 million during the first full year of operation in 1964 for Keystone and Oologah Lakes, Table 22. In 1965, the year both Lakes Dardanelle and Eufaula were opened, attendance increased to 6.6 million. As other locks and dams were completed and added to the System, and with the big recreation boom of the late 1960's and early 1970's, visitations increased to 9.4 million in 1970 and then to 15.8 million in 1975. Had it not been for higher gas prices, high inflation rates, and depressed economic conditions in both the 1974 and 1975 major recreation season, total visitations likely would have increased even more.

Fishing and sightseeing continue to be the most favored activities, as measured by activity days. However, swimming and camping in Oklahoma are increasing each year. From an economic impact standpoint, camping and boating probably are most important; certainly both of these activities have become increasingly popular in the System since 1970, and are likely to continue that trend.

Table 22. Recreation Attendance at the Navigation Plan Features, 1963-1975

Year	Main Stem Locks and Dams, Lakes	Upstream Lakes			Total
		Oologah	Keystone	Eufaula	
		- 1000 visitor days -			
1963	-	324	-	-	324
1964		719	479	168	1,366
1965	1,589 a/	1,148	1,582	2,305	6,624
1966	1,318	937	2,001	2,158	6,414
1967	1,217	1,178	1,794	2,002	6,191
1968	1,034	1,093	1,833	2,313	6,273
1969	2,304	1,057	2,152	2,766	8,279
1970	2,825	966	2,440	3,215	9,446
1971	2,991 b/	884	2,585	3,982	10,442
1972	4,562 c/	1,103	2,893	4,602	13,160
1973	4,918	1,326	3,138	4,522	13,904
1974	4,850	1,219	3,674	4,562	14,305
1975	6,693	1,409	3,022	4,695	15,819

a/ Lake Dardanelle and Lake Eufaula were opened.

b/ Ozark Lake, L&D 13, L&D 9, Toadsuck Ferry L&D, Murry L&D, Robert S. Kerr Lake and W. D. Mayo L&D began.

c/ Chouteau L&D, Newt Grahams L&D, Webbers Falls Lake began.

Source 1.

To illustrate the relatively rapid increase in visitor day use of these Navigation Plan features more clearly, these data are presented in graphic form in figure 12. Data are plotted for attendance at the mainstem locks and dams, and lakes as well as the total attendance. The trend is generally upward even though there seem to be plateaus reached at times, such as that demonstrated by total attendance during 1965-1968.

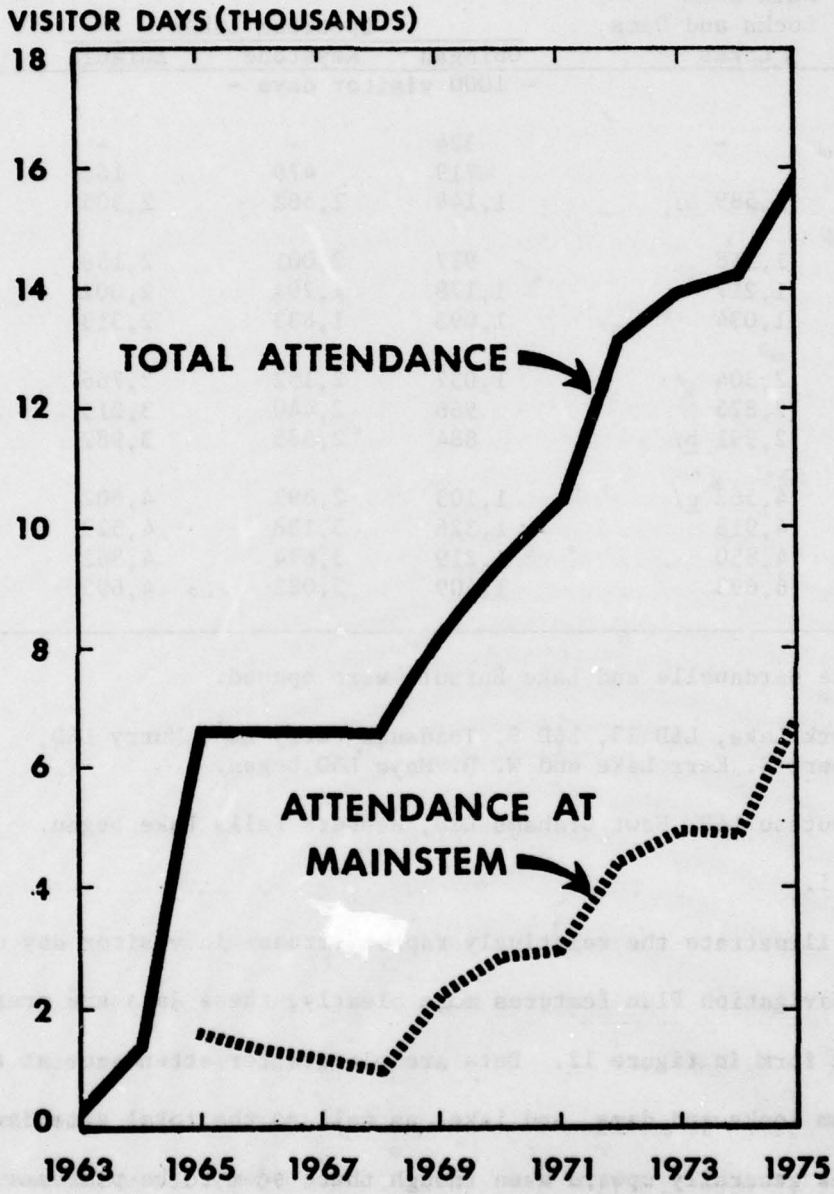

FIGURE 12. RECREATION ATTENDANCE AT THE NAVIGATION PLAN FEATURES, ARKANSAS RIVER, 1963 - 1975.

Source 2.

It should be noted that additional visitations occured at Tenkiller and Ft. Gibson Lakes which are not a part of the Navigation Plan, but are a part of the Navigation System. Investment in recreational facilities at these two lakes by the Corps of Engineers, by the State Parks Department and by both private businesses and recreationists (seasonal and permanent homes, boat docks, etc) has been significant and was accomplished primarily before more recent restrictions upon Federal expenditures for these purposes.

Planned recreational developments on some of the lakes and locks and dams in the System were delayed two to three years due to federal capital investment cutbacks, combined with rising costs of construction. Many of the facilities at recreational areas on the lakes and at the locks and dams were completed in 1974 and 1975, and more are scheduled for completion in 1976. As these public facilities are completed, and as the local supportive businesses (dry boat storage facilities, marinas, service stations and stores, etc.) are built, the recreation impact of the waterway should become even greater in the next few years.

Recreation Participation. Recreation attendance for the mainstem lakes, and the locks and dams on the waterway and the three upstream lakes totaled almost 16 million visitor days in 1975. Social characteristics of visitors were compiled during the 1974-1975 period using surveys. Approximately fifty percent of the heads of households were between the ages of 30 and 49. The average age was 42 years. Seventy-five percent or more off all recreationists have at least a high school education.

One third of all recreationists who are the heads of households are white collar workers (professionals, managers and administrators, sales and clerical workers).

Household Income

Household income is the one socio-economic variable that probably influences recreation participation most. A prerequisite to participation is the availability of purchasing power to engage in the recreation experience. Income level, of course, is influenced by many other socio-economic variables. Approximately 70 percent of all recreation groups, surveyed in 1974 and 1975 reported family incomes of $9,000 or more, Table 23, compared to approximately 41 percent for residents of the area in general (1970 Census). The median income level for respondents falls in the $12,000 to $14,000 income class. These figures are considerably higher than the $7,725 median household income for residents of Oklahoma (1970 Census). It appears that persons with higher household incomes are more likely to participate in water-based outdoor recreation than those with less income.

Table 23. Annual Household Income Based on On-Site Recreation Survey, Arkansas River Navigation System, 1974 and 1975

	1974		1975	
Income Class	Number	Percent	Number	Percent
Under $3,000	30	2.97	41	3.76
3,000- 4,999	37	3.67	61	5.59
5,000- 6,999	73	7.23	78	7.14
7,000- 8,999	111	11.00	99	9.07
9,000-11,999	189	18.73	176	16.12
12,000-14,999	212	21.01	218	19.96
15,000-19,999	174	17.25	196	17.95
20,000-29,999	113	11.20	125	11.45
30,000 and over	25	2.48	34	3.11
No Response	45	4.46	64	5.86
TOTAL	1009		1092	

Source 3.

Travel Zone

The percentage distribution of recreation groups with respect to miles traveled to reach the recreation area are revealing. The patterns are very similar between the two survey years. Forty-three percent of respondents in the 1974 survey traveled less than 50 miles to reach the recreation area. Approximately 52 percent of the 1975 respondents traveled less than 50 miles. This indicates that a large part of the recreational use is localized. Another 22 percent of users travel more than 50 but less than 100 miles to reach the recreation area. Since these are one-way distances, the average recreation group in 1974 drove about 244 miles to engage in the recreation experience. This distance was somewhat shorter, about 190 miles, in 1975. About 3 percent of the recreationists had traveled over 500 miles to reach the area in both 1974 and 1975.

Length of Visit

The average length of stay for a recreation group was about 3.4 days. The 1975 sample indicates that there were more "less than a day" users in 1975 than there were in 1974. Also, there were fewer "two nights or more" users in 1975. This finding is consistent with the shorter distance traveled by the average recreation group in 1975. Shorter driving distances are associated with an increase in day use activities where the recreationist can return home the same day.

Recreation Expenditure Impacts. The economic impact of recreational activities developed along the Arkansas River is manifested through increased business receipts, generated employment and added regional income. Part of the recreational activities development is readily visible in such businesses as marinas, bait and tackle shops, lakeside restaurants and motels, and float trip services. However, much of the general economic activity due to recreation development is inseparable from developments of river transportation, agriculture, manufacturing, and other natural resources. In this section the impact of recreation development is presented in terms of expenditures by on-site recreation participants and seasonal and permanent home owners residing near the lakes and navigation system. Data are the results of recreation participant interviews during 1974 and 1975.

Visitor Day Expenditures

During the 1975 recreation season of May through September about 16 million visitor days were recorded at lakes and along the navigation features of the Arkansas River system. A visitor day refers to a visit by one individual to a recreation site for recreation purposes for any portion of a 24-hour period measured from midnight. Interview data show that average expenditures per visitor day were $6.01 for trip expenditures and $3.52 for annual expenditures giving a total expenditure of $9.53, Table 24. Trip expenditures refer to expenditures incurred during one particular outing for lodging, food and beverages, transportation, and recreation related activities. Annual expenditures for boating, fishing, skiing, and camping refer to expenditures incurred not only for

Table 24. Expenditures by On-Site Recreationists, Navigation System May through September 1975

Expenditure Category	Expenditure per Visitor Day ($)	Aggregate Expenditure ($1,000)	Percentage of Expenditure in Region
Trip Expenditures			
Lodging	0.38	6,968	85
Food and Beverages	3.38	61,670	78
Transportation	1.43	26,119	72
Recreation Activities	0.70	12,810	93
Miscellaneous	0.12	2,266	71
Subtotal	6.01	109,833	79
Annual Expenditures			
Boating	1.06	19,331	70
Fishing	1.01	18,530	66
Skiing	0.18	3,307	43
Camping	1.27	23,239	61
Subtotal	3.52	64,407	64
Total	9.53	174,240	73

Source 4.

that particular outing but for the entire recreation season. The data in Table 24, however, show the prorated expenditure for each visitor day of the total recreation season. These expenditures do not include investments in major recreation equipment items such as boats, campers and tents.

Aggregate expenditures of on-site recreationists are also presented in Table 24, for the May through September season. Aggregate trip expenditures amounted to almost $110 million and annual expenditures

amounted to $64 million for a total aggregate of $174 million. Food and transportation expenditures accounted for about 50 percent of the total. Of all expenditures about 73 percent of the purchases took place within the general region of the river system.

Seasonal and Permanent Home Expenditures

Recreation homes are becoming increasingly popular along lake fronts and development areas with easy access to water-based recreation activities. For the 1974-75 season an estimated 5,496 residences were located near the lake and river system and served as either seasonal or permanent homes. An exact count of the number of residences serving only as seasonal homes was not available but in a sample of 270 homes surveyed, 21 percent used their homes for only a part of each year.

The average annual expenditure per household of seasonal residents for transportation, food and beverages, and utilities amounted to $1,212.68, Table 25. Of this total, 77 percent was purchased within the general region of the river system. Expenditures for recreation activities of boating, fishing, skiing, camping, hunting, and other activities averaged $253.29 per household for seasonal and permanent home residents. About 91 percent of these expenditures were made within the region.

Table 25. Expenditures by Seasonal and Permanent Home Residents, Navigation System 1974-75

Type of Expenditure	Average Annual Expenditure Per Household ($)	Aggregate Expenditure ($1,000)	Percentage of Expenditure in Region	Value of Recreation Equipment ($1,000)
Seasonal Residents[a]				
Transportation	289.45	334	71	
Food and Beverages	648.02	748	71	
Utilities	275.21	317	100	
Subtotal	1,212.68	1,399	77	
Seasonal and Permanent Residents[a]				
Boating	140.91	774	94	
Fishing	70.90	390	88	
Skiing	3.78	21	92	
Camping	5.75	32	100	
Hunting	15.26	84	89	
Miscellaneous	16.69	92	47	
Subtotal	253.29	1,393	91	
Total	--	2,792	84	11,528

[a] Estimated number of seasonal and permanent residences is 5,496. Twenty-one percent are estimated to be seasonal homes.

Source 5.

The aggregate expenditure impact of the 5,496 seasonal and permanent home owners is also shown in Table 24 and amounted to an annual expenditure of $2,792,000. The aggregate value of investments in recreational equipment such as boats, motors, motorbikes, etc., owned by these residents is estimated at $11,528,000. This is an average investment of $2,098 for each household.

FOOTNOTE SOURCES

1. Recreation figures from Tulsa District and Little Rock District, Corps of Engineers.

2. Data from Table 22.

3. Research data, Oklahoma State University, Stillwater, OK.

4. Same as 3.

5. Same as 3.

Chapter VIII

PUBLIC POLICY RESPONSE

Two kinds of public policy response to the waterway are examined. The first is state legislative response, which has had a significant impact through laws permitting the establishment of port authorities. The second relates to a variety of governmental attempts to plan for development. Efforts at bi-state coordination have not resulted in any enduring new institutional arrangements. The states themselves have planned for development, but the Arkansas Waterway Commission remains the only single-purpose state agency concerned with the project's promotion. The Corps of Engineers' land use planning efforts have provided tentative guides to patterns of physical development along the navigation channel. A large number of governmentally financed research and technical assistance reports on the waterway have been prepared.

State Legislative Response. By examining the statutes of Arkansas and Oklahoma and by searching the legislative journals for bills introduced but not passed, it is possible to identify the principal state government responses to the waterway. This examination at the state level is important not only because of what it reveals about the states directly, but also because of its implications concerning the ability of local government units to respond to opportunities created by the waterway.

Port Authorities

Both Arkansas and Oklahoma have adopted legislation permitting the development of port facilities and industrial complexes located at port sites.[1] In terms of real impact on development, these actions appear to be the most important class of legislative response to the waterway. Without ports providing access to water transportation to a broad range of shippers, a major development impact of the waterway would not exist.[2]

Port authorities are special units of government which possess a number of advantages. They may obtain funds for capital investment by issuing tax-exempt revenue bonds. They may also receive grants from other governmental units, such as the Federal Economic Development Administration, U.S. Department of Commerce, and the Ozarks Regional Commission. As with units of government, they are not subject to local property taxes, as is the case with privately-owned port facilities, and their excess revenues (if any) are not subject to federal and state income taxes.

Port authorities are currently operating facilities along the waterway at Pine Bluff, Little Rock, and Fort Smith in Arkansas and Muskogee and the Port of Catoosa in Oklahoma. Authorities have been established, but are not operating, at North Little Rock, Clarksville, Russellville, and Dardanelle in Arkansas, as well as Fort Gibson and Sallisaw in Oklahoma. Another port authority has been established to cover the six Oklahoma counties of Haskell, LeFlore, Latimer, McIntosh, Pittsburg and Sequoyah.

Local units of government take the initiative in establishing port authorities, but this technique for development could not be used without the enabling legislation provided by the states.

Oklahoma first enacted legislation permitting the creation of port authorities in 1959.[3] The legislation was clearly a direct reaction to the construction of the waterway. Arkansas, however, had provided for port authorities in 1947, and as early as 1875 had authorized city governments to build and regulate ports. In 1959 and 1961, powers of Arkansas port authorities were expanded to include multi-city, multi-county and interstate cooperation.[4] The earlier involvement in port development by the State of Arkansas is due to its access to the Mississippi River and the existence of commerce on the lower Arkansas River.

Recreation Facilities

A totally different kind of developmental response to the waterway is found in these two states by the creation of parks along the waterway and at the upstream lakes. These parks provide a variety of opportunities for water-based recreation, and subsequently have had a substantial effect on local economies. Legislative appropriations supporting facilities such as Arrowhead and Fountainhead State Parks on Lake Eufaula, Keystone Lake Park on Lake Keystone, the Will Rogers Recreation Area on Lake Oologah, and Lake Dardanelle State Park illustrate this kind of state response.

Arkansas River Basin Compacts

Interstate compacts relating to the Arkansas River Basin received legislative approval between Oklahoma and Kansas in 1965 and between Oklahoma and Arkansas in 1971. In each case the major purposes of the compacts are:

a) to promote interstate comity...

b) to provide for an equitable apportionment of the waters of the Arkansas River between (the two states)...and to promote the orderly development thereof...

c) to provide an agency for administering the water apportionment agreed to...

d) to encourage the maintenance of an active pollution abatement program in each of the two states and to seek the further reduction of both natural and man-made pollution in the waters of the Arkansas River Basin.[5]

In addition, the Arkansas/Oklahoma compact includes as a major purpose the promotion of cooperation between the states' water administration agencies "in the total development and management of the water resources of the Arkansas River Basin."

A principal feature of the Kansas/Oklahoma compact involves agreements concerning maximum new storage capacity in the relevant area of the Basin in the two states. The Arkansas/Oklahoma compact does not address itself to maximum storage capacity, but rather deals with the rights of the two states with respect to the annual runoff in the relevant portion of the Basin. With respect to these allocations, an explanatory supplement to the compact states:

> The allocations are of such magnitude...that the states will essentially be unrestricted in the control and use of the water resources of the Compact area. The Compact does, however, protect against the possibility of either state encroaching upon the rights of the other at some future time when maximum utilization could be approached.[6]

Planning and Zoning

In their provision of powers for local subdivisions with respect to planning, zoning, subdivision regulation and building codes, both state

legislatures have addressed the special conditions existing along navigable waterways. Oklahoma law permits county commissioners in a county with a major reservoir or upstream terminal port "to establish zoning regulations, a building code and construction codes, and a housing code" for all or a part of the entire unincorporated area of the county.[7] The Arkansas statute extends the area for which cities and towns have planning jurisdictions in the case of cities located along navigable streams.[8]

In 1969 and 1971, bills were introduced in the Oklahoma Legislature providing for planning and zoning along the waterway. Neither bill was passed.[9]

The Arkansas Waterways Commission

In 1967, the Arkansas Legislature established the Arkansas Waterways Commission as a state agency.[10] The Commission consists of seven members, five of whom represent the state's five navigable and potentially navigable stream basin areas. The other two members are appointed at large. The staff of the Commission consists of an executive director and a secretary. The Commission and its staff are involved in a wide range of activities promoting the development, management and utilization of the state's waterways. It serves as a focal point for state government response to issues concerning commercial navigation. Other state agencies are required to coordinate with the Waterways Commission when their activities may impact upon the use of a navigable waterway.[11] There is no state agency in Oklahoma with responsibilities parallel to that of the Arkansas Waterways Commission.

Highway Transport

The pattern of highway construction in both states has had a significant impact on the intermodal accessibility of sites along and near the waterway. This has included such activities as the construction of industrial access roads, and roads to recreation facilities. The turnpike system in Oklahoma and the interstate highway system in both states have great significance in the waterway area's development, but the major routes cannot be viewed as having been stimulated by the waterway.

In 1971 the Oklahoma Legislature passed a law permitting trucks to carry manufactured items as wide as 16 feet from locations within 75 miles of the waterway for shipment by the waterway.[12] The item may not weigh more than 72,500 pounds. This Oklahoma statute does not take precedence over federal statutes where shipments are on the interstate highway system.

Summary of State Legislative Response

Legislative response to the waterway in both states, as indicated by changes in statutes, has largely been of a passive and permissive character. Provision has been made for local governments to establish port authorities and exercise certain kinds of controls over land use. There have been no major programs of state-financed investment in waterway-related facilities, nor have the states provided any special kind of governmental agency responsible for comprehensive planning and development. However, as will be seen in the following section,

state governments operating through their executive branches have responded in a variety of ways to the development and completion of this massive federal investment.

Planning for Development. There are four principal categories under which governmental planning for development of the Arkansas waterway may be examined:

(1) Two major interstate efforts have been made by Arkansas and Oklahoma to plan for the region's development;

(2) Planning efforts have been undertaken unilaterally by the individual states;

(3) The Corps of Engineers, in connection with its operation and management of the project, has engaged in planning activities; and

(4) A large number of research and technical assistance studies relating to the waterway have been undertaken with support primarily from federal agencies.

Interstate Efforts

The Ozarks Regional Commission has supported two large-scale efforts at planning for the development of the waterway. Both were undertaken under the sponsorship of the Governor's Offices of Arkansas and Oklahoma

and resulted in reports containing extensive recommendations for new state postures with respect to the waterway. To date, neither effort has resulted in any significant statutory implementation.

Frontiers of Science Project

The governors of Arkansas and Oklahoma met in December, 1969 to discuss the waterway's future development. They concluded that it would be desirable for the two states to have essentially similar legislation relating to the waterway. Early in 1970, each governor appointed a 30-member study committee, consisting of key representatives from communities and commercial and governmental interests concerned with the waterway. A steering committee was appointed to coordinate the work of the two state committees. In addition, five subject-area task forces were established to gather information and make recommendations on coordinating planning and development efforts. With financial support from the Ozarks Regional Commission, the task forces prepared a large comprehensive report. Work on the entire project was managed through an arrangment with the Frontiers of Science Foundation of Oklahoma, Inc.[13] The recommendations developed from this two-state effort were as follows:

(1) The Governors of Arkansas and Oklahoma should immediately establish by executive order an Arkansas-Verdigris River Planning Commission in each state.

    (a) The purpose of these Commissions should be to act jointly to provide an ongoing bi-state effort of research and planning to assure optimal development and use of the waterway area.

(b) The Commissions should be small and representative of affected local units of government, state agencies, and citizens groups concerned with the rivers.

(c) The Commissions should be supported initially by staff of existing state agencies, but additional funds should be sought from federal sources and state appropriation if needed.

(2) In cooperation with their Commissions, one or both states at their election may prepare and submit a proposal for interim legislation to provide for:

(a) The establishment of minimum acceptable standards for planning, development, and land use along the waterway;

(b) Appropriate authority and organization for coordinating local governmental planning and zoning along the Arkansas-Verdigris waterway;

(c) The funding basis for each state's Arkansas-Verdigris River Planning Commission; and

(d) Funding and technical assistance for local governmental planning and zoning.

(3) A goal and schedule should be set for the Arkansas-Verdigris River Planning Commissions, acting jointly, to recommend by-state action on a more permanent basis.

(a) The Committee recommends establishing an interstate compact. Other forms of permanent bi-state action shall be given consideration if the Commissions, acting jointly, determine that this is advisable.

(b) A specific detailed proposal and draft legislation should be submitted to the Governors at the earliest possible date and a public information program initialed to implement it.[14]

In late October, 1970 the Governor of Oklahoma issued an Executive Order creating the Arkansas-Verdigris River Planning Commission of Oklahoma consistent with the spirit of the recommendations described

above. No such commission was created in Arkansas, and the Oklahoma commission was never implemented.

The Arkansas River Development Corporation

In 1971 new governors took office in both states. Through cooperation with the Governor's Office of Oklahoma, the Ozarks Regional Commission funded the preparation of a report by a private consulting firm, the purpose of which was to:

> ...make recommendations...concerning the status of planning and development work on the Waterway project, summarize what has been done by the different groups, what developments are underway and being planned, and recommend general alternative courses of action...to encourage the development of the Waterway project so that maximum benefit can occur to the economy of the regions affected by the river project.[15]

The report recommended that each state establish an Office of River Development. An interim organization involving the two states in planning for development of the waterway, to be known as the Arkansas River Development Council was suggested, with funding to be sought from the Ozarks Regional Commission.

Although Offices of River Development were never created, the proposal for the Arkansas River Development Council evolved into a bi-state operating organization known as the Arkansas River Development Corporation. The Corporation was organized in February, 1972 and received an initial $90,000 grant from the Ozarks Regional Commission.

The three "members of the corporation" were the governors of Oklahoma and Arkansas, and the Federal Co-chairman of the Ozarks Regional Commission. A board of directors was established, consisting of three representatives from each of the two states and two members representing the Federal government. Principal offices were established at Tulsa, with an office at Little Rock for the corporation's coordinator for Arkansas.

During its three active years, the Arkansas River Development Corporation engaged in two principal kinds of activities. First, it attempted to serve as a kind of region-wide Chamber of Commerce or industrial development agency. Second, it served as planning agency making recommendations for new governmental arrangements to influence the future development of the waterway region. In this capacity, a nine-member task force consisting of three representatives each from Arkansas, Oklahoma and the Federal establishment developed a detailed draft for an interstate compact for the Arkansas River basin. The states of Arkansas, Colorado, Kansas, Missouri, Oklahoma, New Mexico and Texas were to participate in the compact. The draft of the compact, also, called for the establishment of an Arkansas River Basin Commission with broad powers to finance projects and engage in land use planning and control in flood plains where state and local authorities did not operate.[16]

The operations of the Arkansas River Development Corporation were terminated in early 1975, and the corporation's files were moved to the

offices of the Ozarks Regional Commission in Little Rock.

State Activities

As early as 1966, federal HUD 701 Planning Funds were used in the preparation of an extensive "Arkansas River Region Report." The report's recommendations relate primarily to general steps which state and local governments could take to promote manufacturing, mining, and commercial activity on the waterway. The report observes, for example,

> ...[a] considerable degree of cooperation between the two states on the overall development of commerce and industry in the Arkansas River valley ought to be beneficial. Studies in development efforts aimed at building an industrial complex on a broad regional scale are recommended. A properly unified approach could avoid excessive and costly duplication of effort, and perhaps eliminate uneconomic competition for industrial prospects in numerous instance.[17]

In December, 1966 the Arkansas Planning Commission published a document entitled Arkansas River Region Comprehensive Development Plan 1980.[18] This planning document covers the broad region on either side of the waterway in Arkansas, dealing with population, the economy, land use, transportation, public facilities and recreation. A primary conclusion related to the "need for an effective action program for the reservation, regulation and unified development of lands fronting the navigable waterways of Arkansas," and the setting aside of sufficient shoreland for waterfront industrial sites.[19]

In 1968, an Oklahoma Governor's Study Committee on the Arkansas-Verdigris River was appointed and given a set of specific charges. The Committee recommended the establishment of a commission on river navigation to coordinate planning and development of the Oklahoma portion of the waterway. It also recommended that the governor assign temporary responsibility to the state's Industrial Development Department to undertake physical and economic planning in the region.[20]

In January, 1973 the Mid-Continent Environmental Center Association (MECA) published a booklet entitled The Model Arkansas River Basin--A Plan for Action.[21] This association of universities and private business firms was aimed primarily at exploring ways to facilitate cooperation and research on environmental problems. The report recommended that a River Basin Commission be formed and and that the President of the United States declare the Arkansas River Basin to be a "Model River Basin." The MECA recommendations were not implemented, and the organization is no longer in existence.

In addition to cities, counties and conservation districts, both Oklahoma and Arkansas have organizations called sub-state planning districts. These organizations, originally formed as Economic Development Districts under the federal Public Works and Economic Development Act of 1965, perform a variety of functions in coordinating the planning and public investment strategies of federal, state and local units of government.

In late 1973, Oklahoma's state planning agency prepared a draft "Memorandum of Agreement" between the state, the district, and local agencies with regard to planning and development of the McClellan-Kerr Arkansas River Navigation System area.[22] The purpose of this agreement was to provide a mechanism for coordinating the planning efforts of key state agencies, sub-state planning districts and local entities of government with respect to the waterway. For example, parties were to agree to "evaluate, design and install land use controls consistent with the development of their jurisdiction...and to administer planning and land use controls consistent with the local jurisdictions' policies and programs."[23]

An advisory committee was to be established, consisting of the Oklahoma members of the Arkansas River Development Corporation board of directors and other members which the Governor of Oklahoma might appoint. The function of the Advisory Committee was to assist the various governmental entities who signed the "Memorandum of Agreement" and who identified planning needs. In addition, a working group, composed of representatives of governmental entities signing the agreement was to be created. Its pruposes included the development of "procedures for formulating and updating the McClellan-Kerr Arkansas River Navigation System's Area plan, consistent with local and Substate Districts' plan."[24] This purpose appears to imply the anticipation of some sort of comprehensive plan for the waterway embodying the coordinated planning efforts of the various governmental units. This proposed agreement was not implemented.

Although not a direct response to the waterway, mention should be made of Oklahoma's planning efforts with respect to a state-wide water system in which it was anticipated that a substantial amount of excess water from the state's eastern basins will be transferred to the more arid western regions.[25] To date, this planning effort has focused on the southern part of the state, and has not planned for transfers from the waterway system region. When this effort is directed to the northern part of the state, it would appear that a comprehensive approach to planning for development and water use in the waterway region will be necessary.

The Corps of Engineers

The Corps of Engineers manages and maintains the waterway and almost all of the upstream reservoirs feeding into the waterway. In addition, the Corps owns outright a considerable amount of land along the waterway in Oklahoma---particularly the Verdigris section from Muskogee to the Tulsa Port of Catoosa. The Federal River and Harbor Act of 1899 and several later statutes require that a permit be obtained from the Corps of Engineers for a wide range of activities which affect the navigable capacity of a body of water.[26] In addition, the permits program created by Section 404 of Public Law 92-500 is administered by the Corps.

In order that land under Corps ownership may be managed efficiently, or returned to private ownership if not needed to permit safe & efficient

project operation, regular land use assessment studies are conducted. The studies provide the basis for recreation site development, management of habitat for fish and wildlife; maintenance dredging material storage; shoreline management; and reservoir release operations.

It must be emphasized, however, that while the Corps of Engineers maintains a vital interest in monitoring the developmental effects of the waterway, it does not actively promote industrial and commercial development, as is currently the case with various Chambers of Commerce and state industrial development agencies. The Corps does possess power to control lands along the waterway, in which it has an interest, through purchase or lease but not powers of zoning comparable to local or state governments.

Research and Technical Assistance

Time and space do not permit a detailed discussion of the massive amount of research and technical assistance activities which have been undertaken in connection with the waterway. Rather, an attempt is made here to outline, with selected examples, the principal thrusts of these activities.

By far the largest amount of research dealing with the developmental effects of the waterway has been undertaken by, and with the support of, the Corps of Engineers' Institute for Water Resources. This organization has developed an overall research design for assessing the socio-economic effects of the project, and it is responsible for maintaining

an ongoing assessment program.[29] A principal problem in the design of research dealing with the specific impact of the waterway remains that of sorting out the numerous other forces affecting development in the region and isolating the waterway's effects.[30]

Federally-funded Water Resources Research Institutes at Oklahoma State University and the University of Arkansas have supported research relating to the waterway project.

Technical assistance projects include a study of sites for manufacturing, warehousing and inter-modal cargo transfer on the waterway in Arkansas,[31] a survey of industrial sites in the Oklahoma portion,[32] a report on potential port sites,[33] and an analysis of locations appropriate for the chemical processing industry.[34]

FOOTNOTE SOURCES

(1) 82 O.S. 1971 § 1101 et. seq.; 19 A.S. 1947 § 2701 et. seq.

(2) Talor, Phillip H., L. D. Belzung and M. H. Sonstegaard. Regional Response Through Port Development: An Economic Case Study on the McClellan-Kerr Arkansas River Project. Fayetteville: Bureau of Business and Economic Research, August, 1974, (U.S. Army Engineer Institute for Water Resources, Contract DACW63-72-C-0145).

(3) 82 O.S. 1971 § 1101 et. seq.

(4) 19 A.S. 1947 § 2702 et. seq.

(5) 82 O.S. 1971 § 1401 et. seq.

(6) Arkansas River Compact Committee. Arkansas River Basin Compact Arkansas-Oklahoma, 1972, with Supplemental Interpretive Comments. Sup. No. I. Austin: Office of Representative, United States, Revised March 3, 1972, p. 12.

(7) 19 O.S. 1971 § 866.2

(8) 19 A.S. 1947 § 2829

(9) SB 292 (1969) and SB 230 (1971)

(10) 21 A.S. 1947 § 1701-03

(11) Arkansas Waterways Commission. Biennial Report December 15, 1972-December 15, 1974. Little Rock: January 14, 1975.

(12) 47 O.S. 1971 § 116.21

(13) Frontiers of Science Foundation of Oklahoma, Inc. Project to Plan for Orderly Development of Arkansas-Verdigris Waterway Area. Two volumes. Oklahoma City: Frontiers of Science Foundation of Oklahoma, Inc., May, 1971. (Ozarks Regional Commission ORC TA69-9 (NEG)).

(14) Ibid., Vol. I, pp. 6-7.

(15) The John Story Company. Courses of Action to Encourage Development of the Arkansas River Navigation System. Tulsa: John Story Company, September, 1971. (Ozarks Regional Commission TA70-20 (NEG) 0-3) pp. 1-2.

(16) Arkansas River Development Corporation. Arkansas River Corridor: Resources and Responsibilities. Three volumes. Tulsa: Arkansas River Development Corporation, 1974. (Ozarks Regional Commission TA73-16 (NEG)). See Vol. II for compact recommendations.

(17) Arkansas Planning Commission. Arkansas River Region Report--Economic Development Forecast and Recommendations. Vol. IV. Little Rock: Industrial Research and Extension Center, June, 1966, p. 36.

(18) Arkansas Planning Commission. Arkansas River Region Comprehensive Development Plan 1980. Little Rock: Associated Planners, Inc. December, 1966.

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Chapter IX

OPPORTUNITIES AND PROBLEMS

The preceeding chapters have focused on various dimensions of development within the Navigation Plan Area. The entire project is relatively new; it has been fully operational only since January 1971. The five years which have passed since then have been characterized by a generally lagging national economy. Hence, it is not surprising that opportunities for project-related development have not progressed rapidly. Moreover, it is reasonable to expect that certain problems lie behind some of the potentials for quality development. This chapter reviews some of these opportunities and problems. Major topics of concern are industrial development, project operations, environmental management, project-related local services, and institutional arrangements.

Industrial Development. As pointed out previously, the Navigation Plan Area remains one of relatively low per-capita, personal income with relatively high incidence of poverty. The creation of quality industrial development projects with relatively high paying jobs remains high on the region's list of priorities.

The region's response to the waterway with respect to port development and the creation of port-related industrial parks has been generally positive and timely. In addition, private developers have acquired some key parcels of land of anticipation of future development. However, an important constraint on waterway-related industrial development may

result from the fact that there are a limited number of sites combining ready access to the waterway with adequate rail and highway transport facilities.

Another potential problem area, with respect to industrial development, involves the absence of extensive feasibility studies pinpointing kinds of industrial activity at optimum locations along the waterway. It is not clear just to what extent the public sector should go in terms of financing this kind of development, as opposed to placing reliance on the private sector. It has been stated, by a number of leaders of the region involved in industrial development, that there is a need for greater efforts toward this end.

Project Operations. There are a set of problems associated with the physical operation of the waterway project. Some of these problems are inherent in the multipurpose functional design of the project, while others may be amenable to solution through physical modification and new management techniques.

Two operational opportunities and related problems are the constriction in the river flow at Van Buren, Arkansas, and the periods of very high water flow which impede navigation throughout the waterway, generally.

The original project design estimated that, at a 22 foot stage, the river at Van Buren, Arkansas, would flow at a rate of 150,000 cubic feet per second. For reasons which are not clearly understood, the actual

capacity of the river at this point is currently less than what was originally estimated. While the rest of the river has its estimated capacity, this constriction reduces the ability of the system to perform flood control functions most efficiently. Therefore, it takes longer to draw down the flood control storage levels in the system after a period of heavy rains, and periods of rapid water-flow down the Arkansas must be of longer duration than would otherwise be the case. Of course, periods of rapid water-flow are inherent in the basic character of the system, but ideally, their duration should be minimized in order to facilitate navigation.

Since the system opened to navigation in 1970, flows on the Arkansas have exceeded average flows of the period 1944-1970.[1] Flows were particularly high from October 1970 through a large part of 1974. The more rapid the flow of water, the more energy is needed to move cargoes upstream and the more treacherous the navigation effort itself. As flows increase, smaller towboats do not operate, and, finally, all towboats cease operations when high flows require it. This problem of high stream-flow has reduced the traffic on the waterway during high flows, and adversely affected some shippers' assessment of the reliability of water transport.

A related operational problem of concern to shippers and towboat operators is the maintenance of the navigation channel at some locations to its designed depth of nine feet and its designed widths of 250 feet on the Arkansas River, and 150 feet on the Verdigris River.

High stream flows affect the cost of river transport; another potential cost-raising factor could be encountered if Federal waterway user charges are implemented.

Both at the three lakes associated with the Navigation Plan features (Keystone, Oologah, and Eufaula), and the nine other major upstream lakes feeding into the system, there remains some conflict between recreation uses and other functions of the waterway which create fluctuations in reservoir levels. Lake levels may be drawn down for the purpose of power generation, or may fluctuate upward as the system performs its flood control functions, both changes may be undesirable from the optimum level for recreation.

Environmental Management. Fluctuations in lake levels can adversely affect the quality of the recreational environment and create difficulties for operators of boat docks and marina. Mud flats develop during low-water periods, and some recreation areas are flooded when waters are retained to reduce damages downstream. Flood waters retained in the lakes of Keystone and Oologah during the high water period of 1973 killed a number of the indiginous trees which had been growing in recreation areas.[2] This suggests an opportunity for careful selection of vegetation to be nurtured in areas subject to flooding, especially recreation areas.

There is a continuing problem of shoreline management in the lakes around the navigation plan features. Many of these problems are associated with the strong demand for facilities for water-based recreation

combined with the growth of seasonal, second-home residences. There is a continuing opportunity for development of rational land-use patterns around the lakes which protect the competitive and complementary interests of different types of recreationists.

Both natural and manmade water pollution are problems in the navigation plan area. Possibly the most important pollution problem relates to the high chloride content of the Arkansas River. The river's waters are too salty for many uses because of the fact that it flows across salt beds in its western part. The Corps of Engineers is examining a number of technological solutions aimed at reducing the river's chloride content.

There are a limited number of areas along the waterway that combine the availability of water, rail and good highway transportation access. Similarly, there are other sites that are ideally situated for recreational activities of different types. Other parcels of land are suited to certain kinds of industrial activities which do not require complete intermodal access. Thus, there are a number of sites in the direct proximity of the waterway, and of the lakes feeding into it, that are specially suited to the performance of certain kinds of functions. Because of uncertainty with respect to the future course of technology and development in the region there is an opportunity to preserve and protect sufficient flexibility in land use activities. This opportunity is more relevant than that of designing an overall land use plan in the spirit of the practice of city planning.

Local Services. While the Federal government plays key roles affecting the project operations and environmental management, state and local governments are important providers of local services which are needed in connection with the operation of the multi-purpose McClellan-Kerr Arkansas River Navigation System. Heavy recreation usage brings with it a host of problems involving the supplying of local services such as police and fire protection, access roads, and recreation facilities themselves. More needs to be learned about the impact of areas with heavy concentrations of water-based recreation activities on the socio-economic structure of the immediate environment.

Better long-distance, ground transportation is needed in the Oklahoma portion of the Navigation Plan area extending westward into the heart of the grain producing region. Better port and storage facilities whether publicly or privately supplied--are probably needed in order to promote full utilization of the waterway for the transportation of agricultural commodities. There may, also, be a need for better storage facilities along the waterway for agricultural inputs, such as solid fertilizers.

Institutional Arrangements. Several major attempts at planning for the development of the Navigation Plan area were described previously in the report. None of these attempts have proved to have lasting significance, and, for the most part, they resulted in no specific actions. Thus, there is the anomaly that various groups in both Arkansas and Oklahoma have asserted that additional development planning needs to be undertaken for the development of the waterway, but no actual comprehensive planning has been widely acceptable nor implementable. This

raises a question as to whether the absence of comprehensive river basin planning is a problem and whether there is an opportunity for some form of new institutional arrangements to be developed to fullfill this need. There does not, at this time, seem to be significant support in either state for comprehensive land-use planning in the navigation plan area. Land use planning is usually assumed to be a feature of any sort of comprehensive planning effort. It may also be possible that the two states of Arkansas and Oklahoma do not have a great deal of joint interest in the development of the waterway which would require joint institutional arrangements.

Finally, the opportunity remains for various institutions concerned with development of the navigation plan area to provide improved information about the area's current development status and prospects for future growth. This challenge implies that private and public decision-making will be sufficiently flexible and rational so that the nation and the area will receive the optimum benefits from the $1.2 billion Federal investment.

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